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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

JANUARY 13.

Institute of Metals (Scottish Local Section) :—Ordinary meeting at Glasgow. "Extrusion, and a Consideration of Some of the Physical Properties affecting the Production of Rods, Tubes, and Sections by this Process," Paper by A. Wragg.

JANUARY 14.

Institute of Metals (North-East Coast Local Section) :—Ordinary meeting. "Chromium Plating," Paper by L. Wright.

JANUARY 16.

Institute of Metals (Birmingham Local Section) :—Joint meeting at Birmingham. "Modern Annealing Furnaces," Paper by J. Fallon.

JANUARY 21.

Sheffield Metallurgical Association :—Ordinary meeting at Sheffield. "Temperature Distribution and Stress Effects in Heating and Coaling Masses," Paper by G. Stanfield, M.Sc.

Institute of British Foundrymen.

JANUARY 11.

Wales and Monmouth Branch :—Ordinary meeting at Cardiff. Lecture on "Jobbing Moulding," by S. Southcott.

JANUARY 17.

Sheffield and District Section :—Ordinary meeting at Sheffield. "The Heat Treatment of Castings," Paper by R. Whitfield.

Patented Alloys.

Two more outstanding British industrial establishments have recently developed alloys claiming to be an advance on well-known alloys covered by engineering specifications. For these, trade marks have been registered. In the publicity for their new products some well-known existing alloys are often severely criticised, which fact is liable to bring out denials from metallurgists who have spent years of their life perfecting specified materials. It is apparent that research work can be oriented into two channels, the first type being designed to facilitate the economic production of specified material, and the second to produce a material of a unique character, destined to supersede an existing specification-alloy.

Immediately a firm has accomplished the second activity, it has probably precluded the acceptance of the alloy by the great national buying departments, as they have automatically cut out competition for their product. On the other hand, the production of a new alloy may fill their shops from private buyers, whilst again ingotted metal for remelting may be sold to other foundries or licences to manufacture may be granted.

It is to be noted, however, that every alloy bearing a trade mark is subjected to a maximum amount of adverse "gossipy" criticism. Priority, validity of patents, novelty, restrictivity of utilisation are all the subject of comment. The virtual impossibility of recognition by the authorities places these real products of research at a disadvantage, and no good word will be said in their favour until the patents have elapsed, when some of them will get the blessing of orthodoxy and be standardised by the "authorities." It seems to us that the time is ripe for a protection society to be formed to ensure that real innovations in alloy production receive a square deal.

For many categories of steel alloys, little is specified and standardised, yet excellent progress is being made. If a firm develops a new high-speed steel, a trade mark is registered, its performances detailed, and if it successfully meets its claim in the engineering industry, it marks a new era until something better is found. If an improvement is made of the linear variety, then a word such as "ultra" or "super" is tacked on to the original trade mark. But whenever standardisation and specification has captured a type of alloy, the whole aspect is changed, as little latitude for anything but orthodoxy is given to the user. Apparently, in some establishments, the successful meeting of specification numbers X, Y, Z is the alpha and omega of their industrial existence.

Making and Marketing.

Ever since, on a memorable occasion, the Prince of Wales dignified salesmanship by declaring its importance, the subject has been the focus of considerable interest, and it is to be hoped that some measure of this interest will be directed towards the interim report of the Committee on Education for Salesmanship, which deals with British marketing overseas. The subject matter of this report seems of very real importance to all who are concerned directly or indirectly with the export trade of the country. It is based upon much authoritative evidence from Trade Commissioners and Chambers of Commerce all over the world, and, although it is recognised that many firms and individuals are as up to date as can be desired, a good deal of serious criticism is either expressed or implied. We are told that, although British goods no longer sell themselves, their manufacturers continue to act as if they did, judging by their own lack of interest in overseas markets, the inadequate status they give to their salesmen, and the lack of confidence they repose in salesman and agent alike. More than one witness is cited as saying that, "if the market is not worth studying, it should be left alone," and the ideal appears to be a preliminary survey of all markets by a principal, the selection of a first-class man with special local knowledge, and the support of this man subsequently by adequate remuneration, full confidence and constant co-operation.

Two points of special significance emerge from the report. The first relates to knowledge of foreign languages, and its importance is to be demonstrated by the Committee in a special report. As this is a matter to which we have referred repeatedly, we are particularly impressed by the fact that many witnesses consider an inadquate knowledge of foreign languages to be one of the biggest handicaps of the British salesman, especially as the salesmen of other nationalities are far better equipped.

The other point does not in a sense come within the purview of the Committee, but it

does concern British industrialists very closely, for it is in effect yet another urgent appeal for economy. British goods have a high reputation for quality, and there have been in the past, and still are, a number of markets where they sell on the strength of that quality, quite irrespective of price. We recall a report on trade with the United States which emphasised this. But the countries that are capable of offering a high-grade market are increasingly tending to satisfy their requirements at home, leaving as the biggest opening for our export trade the more backward and less wealthy populations of newly-formed European States, of South America, and in the East. These people have in many cases a low purchasing power; they demand cheap goods to serve an immediate purpose, and, even if they are willing to admit the superior quality of the British article, they are not always able to act on the admission on account of the higher price. The report states that "there is a very strong and healthy aversion in this country from doing anything which might lower the reputation for quality enjoyed by British goods," and goes on to commend this attitude, while pointing out that there are big openings in the market for cheaper goods. It remains for us to point the obvious moral, which the Committee is apparently unable or unwilling to do, that more economical production would go some way towards reducing the difference in price between our own and other countries' manufactures.

A £5,000,000 Steel Merger.

Messrs. Guest, Keen & Nettlefolds, Limited, and Baldwins, Limited, announce that, subject to the preparation of a detailed scheme and to the necessary consents being obtained, it has been agreed that a company be formed to take over and operate as from January 1, 1930, the coke ovens, blast furnaces, steelworks and heavy steel-rolling mills of the two companies.

The new company will be assured of its own sources of supply of limestone, iron ore and coking coals. The board will be appointed by the two companies concerned, and the capital will amount to £5,000,000, but no public issue is involved as the shares will be held by the two parties.

It is understood that Sir John Field Beale (chairman of Guest, Keen & Nettlefolds, Limited) will be chairman, and Sir W. Charles Wright (chairman of Baldwins, Limited) deputy-chairman of the new company.

Prepare for Business. . . .

Mr. Fred Erb, President of the American Foundrymen's Association, has issued the following personal message to the members of that Association:—Foundrymen now have a great opportunity to serve their country by diligent application to their business. Fundamentally, conditions are sound. Confidence has supplanted the unreasonable uncertainty that threatened to interrupt prosperity. Business leaders have demonstrated their faith in present conditions by pledging definite expenditures for expansions, improvements and maintenance.

Accepting that the expressed confidence in the future of American business is well founded, what should we, as foundrymen, do? The business pace in 1930 is going to be a fast one. Competition will be keen and efficiency is going to weigh heavily in the balance. Therefore, now is the oppertune time to install labour-saving devices, replace obsolete machinery and buy, build and make wise expenditures to carry on our businesses more efficiently.

With foundrymen, as with all others, this means simply: Prepare for business and then go after it!

Britain's Oldest Foundry Foreman.

Mr. George Davis, at the age of 76, claims to be the oldest active foundry foreman in Great Britain as foreman in the general foundry of Llanelly Foundry & Engineering Company, Limited, where he is responsible for an annual output of 8,000 tons of castings. Asked for a résumé of his career, Mr. Davis told our representative that he was born at Llansteven, in Carmarthenshire, in June, 1853, and started working at Dowlais in 1864. "I left Dowlais for Llanelly in 1866," said Mr. Davis, "and went on a voyag. as a cook in the 'Lord Roll.' I had enough with one voyage, so I joined my uncle, George Willis, at Nevill's Foundry, in Llanelly." The next eighteen years he spent at the Abernant Foundry, Aberdare; Gwalia and Glanmor Foundries at Llanelly, and Dixon's Foundry at Mountain Ash. "At one time," said Mr. Davis, "I was foreman at the Gwalia over four moulders and two boys. Mr. John Powell, the owner, stopped the Gwalia and transferred the lot of us to Glanmor, then known as Powell's Foundry."

MR. GEORGE DAVIS.

In 1884, he was appointed foundry foreman to Morewood & Company, who had a steelworks at Llanelly. Mr. Davis recalled "We had a new foundry built in 1889, and in 1893 I went out to the States, to Gas City, and we put up a new foundry there to cast bed-plates for the new tinplate mills we sent out from Llanelly. I was there three months and then returned to Morewood's Foundry until they stopped owing to bad trade consequent on the MacKinley tariff spoiling the American trade."

However, he soon had a position at Mr. Bob Evans' Foundry at Landore, and when Richard Thomas & Company, Limited, took over Morewood's Foundry he was employed to re-start it. From 1901 to 1905, he was at the Millbrook Foundry, Llandore, but in that year decided to have a foundry of his own, so, with a partner, took premises at Sandy, Llanelly. This he sold in 1909 and, to quote Mr. Davis, "Was lucky not to lose much, as trade was getting pretty bad." After a holiday in the States, Mr. Davis returned to Llanelly to dismantle, rebuild and equip the Glanmor Foundry, staying there until 1914. Then he took a three-year holiday, but became tired of idleness, so that in 1917 he started up the foundry at Llanelly Steelworks. In 1922 he was appointed to his present position. We congratulate Mr. Davis on his long and useful career.

Random Shots.

It has long been fashionable among certain of our veteran daily and weekly papers to devote a little regular space to quotations from early issues of their own journal—headed "A Hundred Years Ago," or "News from the Past," or something of the kind. It is a subtle device, for not only are the extracts often extremely entertaining and enlightening themselves, but they offer a useful variety of propaganda. This constant reminder of the paper's antiquity appeals to all that is most conservative in man. I don't mean conservative here in the political sense, but in the broad human sense in which all men are conservative, whether they be Socialist or Unionist, because they cannot help trusting the old and tried more than they trust the new and unproved. Perhaps this wouldn't apply all over the world; my friends and my reading combine to inform me that it would not be true in the States, where it is fashionable to prefer novelty at all costs; and I suppose Russia—or should I say U.S.S.R.—wouldn't subscribe to it either. But in England the advantage is always on the side of the established order.

* * *

This disquisition arises out of the fact that I have been looking over an old volume of THE FOUNDRY TRADE JOURNAL—the first volume, to be exact. It is a small book, neat but not gaudy, as the poet said, and it contains a wonderfully interesting assortment of material. It had crossed my mind, as a matter of fact, that I might with advantage emulate the features I have been discussing, and cap their accounts of duels and hangings and highway robbery with descriptions of new installations, awards, trade disputes, and so forth, from the remote past. But unfortunately there are difficulties. It is all very well to quote freely from a paper a hundred years old (though even there I dare say one has to be careful about the corns one is treading on), but we can't as yet claim such hoary antiquity. And the trouble is that people who are still flourishing don't want you to proclaim to the world that exact year in which they won a scholarship or a medal, or installed an equipment that they still describe as up-to-date. . . . So if I want to quote for your benefit I must confine myself strictly to generalities.

* * *

It is, however, instructive and amusing to find that a quarter of a century and more ago the foundry trade was exercised in its mind about problems not so very different from those that trouble us to-day. Take this statement, for example: "English founders are considerably behind their brothers of Germany and America in the matter of having laboratories attached to their foundries to test and analyse the various brands of pig-iron and coke that are being used daily in the foundry." Or again: "Trade schools may yet fill a place in our educational system, but they will never be a substitute for an intelligent, comprehensive apprenticeship system."

* * *

By way of a change, it is strange to read of "an exhibition, exclusively confined to the produce and manufactures of the British Empire . . . in the Tauride Palace, St. Petersburg . . . lent for that purpose by the Empress." I also encountered a prophecy that American industrial competition would one day have to be taken seriously by this country (I can't at the moment find the exact quotation). So times have changed after all! . . .

* * *

I will give you some more of these extracts another time.

MARKSMAN.

Non-Ferrous Metals in 1929.

(From a Special Correspondent.)

It is not surprising that during a year when inflation of Stock Exchange values was rampant, and many commodity values were pushed up to high levels, the prices of non-ferrous metals suffered from the same disability. By the end of the first quarter or thereabouts, however, the worst of the ramp was over, and copper, at any rate, had by the middle of April come down to the level at which it was destined to remain up to December 31, but the other three members of the non-ferrous quartette did not touch bottom till early December. Nickel and aluminium were steady and unchanged throughout the whole period. Sentiment has been bad, and acute uncertainty has characterised the situation, for, particularly during the second half of the year, production was on the up-grade and stocks increased all round. At the moment spelter, lead and perhaps tin may be considered to be pretty well at the bottom, but copper is a very uncertain factor and, according to general expectation, is not unlikely to suffer a price reduction in the not far distant future.

The Copper Market.

Copper suffered some very wild fluctuations last year, but actually the quotations ruling at the beginning and end of the year were not very far apart, although the margin between the standard copper quotation and electro had widened by December 31 to an abnormal degree. In January last expectations of an imminent rise in values prompted activity by ball operators, and cash standard at £75 2s. 6d. was less than £3 below the wire-bar quotation of £77 15s., but by the end of the year standard was below £70, while wire bars stood at £83 10s., showing a spread of between £14 and £15. As a matter of fact, the differential was even wider at one period, being in the neighbourhood of £18, and it is not surprising to find that, although a fair tonnage of rough copper was put on warrant during the year, stocks in official warehouses have been reduced by more than 2,000 tons, the bulk of the metal having gone to American refineries for conversion into electro.

In view of the comparative stagnation of the copper market during two-thirds of the period under review, it is difficult to recapture the spirit of ultra-bullishness that permeated the situation during the first quarter of 1929. Production was curtailed in the previous year, and stocks of refined metal in America (the only reservoir under the existing arrangement of marketing) had been allowed to fall to a dangerously low level. Wall Street operators saw their chance to create a scare atmosphere, and very soon had consumers on the run for copper. Wild talk of a famine was circulated in the States, and manufacturers bought lavishly at rapidly advancing prices, for the producers apparently forgot all about their stabilisation programme, and at one period the quotation advanced daily. How much copper changed hands at that time is a matter for conjecture, but it is quite certain that the American consumers took proportionately far more dear metal than their European competitors, although Germany followed the rise beyond the £100 mark, and after the crash tried to re-sell in London at distress prices.

In America the quotation soared to 24⅝ cents, while in London electro touched £112, and standard almost reached the £100 mark. The reaction was sudden and terrible once the bubble burst, and within a few days copper fell £30 to 18 cents in New York and £84 12s. 6d. on this side. Although the fall was apparently precipitated by the Customs smelters who were holding copper they could not sell, the maintenance of a 24-cent level was utterly unjustified, and a setback was inevitable as soon as the price climbed over 20 cents. Amid the welter of recriminations which followed this sorry debacle, the producers blamed the consumers for speculative buying much in excess of their normal requirements, while users, in their turn, left to dispose of thousands of tons of copper at a loss of some £20 to £30 per ton, said very bitter things about the association that had pushed up the price of a metal that was virtually a monopoly.

It is some consolation—although a poor one—to reflect that manufacturers in this country bought comparatively little copper above about £90 per ton, for the very good reason that their customers for wire, tubes and rolled metal refused to believe in the famine bogey and declined to be led into the error of purchasing at the top. On the whole, Britain came through the crisis with considerable credit, and non-ferrous interests generally ought to be congratulated on keeping their heads during an exceedingly difficult period. The aftermath has, of course, been very serious, for confidence was rudely shaken, and, with the prevalence of a feeling that all is not well with the copper situation, buyers have been very shy to commit themselves. Only once since the spring, early in September, was there any sort of suggestion of an advance in the price, and, although a fair amount of copper changed hands, consumers soon realised that the movement was merely a propaganda scare to enable the producers to get rid of stocks which were growing somewhat unwieldly.

A fair amount of uncontrolled electrolytic copper was available during the year, especially during the last three months, and consumers have, therefore, been able to cover part of their requirements at a few shillings per ton below the exporters' quotation. In November a big tonnage of Japanese electro was pressed for sale in Europe, but buyers fought shy, and eventually the exporters took the remaining 7,000 tons or so at a price said to be equivalent to 17 cents per pound. During the concluding months of the year London dealers were offering copper for the second quarter of this year at a substantial discount, but no business eventuated. The present price of copper must be accounted high in view of the fact that costs of production average 8 to 9 cents per pound, and it is undoubtedly acting as a spur to mine output and a check on consumption. In this connection it is worth noting that progress has been made in Germany in the installation of additional plant for refining and that, on the other hand, consumers of copper and brass have turned their attention to aluminium.

On the whole, 1929 was a bad year for dealers in old copper, for the high price in March and April brought out a lot of scrap much of which was subsequently re-sold by holders at a serious loss. Demand by the consuming trades was not up to the usual standards for copper consumption, with the possible exception of the electrical trades, has been below normal, and scrap dealers have been compelled to cut into margins to make sales. In brass the situation was rather better, for makers of extruded rod and sections have been busy and have been regularly in the market for supplies. As in the past two or three years a large proportion of this brass scrap has come from America.

The Tin Situation.

The year opened with tin standing at £225 per ton and stocks in official warehouses in this country at around 7,500 tons, but 1929 proved to be a very disastrous time for holders of this metal, and by the end of December the quotation was below £170, while stocks stood at around 10,000 tons. A twelve month's history can be summed up in three words "too much tin," and it was only right at the end of the year that anything approaching even partial agreement on the subject of mine curtailment was reached. Visible supplies increased—but not steadily. For eight months they registered declines; but the increases in the other four months much more than offset these declines, and had it not been for the support of a powerful group which seemed satisfied to put metal into warehouse, a fall to the level now reached would have been seen long ago. Eventually, this group grew tired of "carrying the baby" and began to liquidate its holding on a weak market; but there have been reports that another band of bold spirits intends to take up the running and it is possible that 1930 may see tin above £200 again.

Tin has always been the plaything of speculators, and during 1929 this fact was again amply demonstrated, for fluctuations were wide and "inspired" reports have played their part in the gambler's game. In the long run, however, facts forced the inevitable drift to lower levels, for amid a welter of misstatements the truth of overproduction has been fully demonstrated. A new factor in the tin situation has been the introduction of trading in futures on the National Metal Exchange in New York, but it cannot be said that the influence exerted on the trend of prices has been very notable, for London quotations remain the all-compelling force in the world's trading.

Although total world-consumption figures are not available, total deliveries are; and these are very favourable, showing, at 141,071 long tons for the year, an increase of no less than 13,204 tons, or 10.3 per cent. on 1928—as compared with supplies of 145,092 tons, an increase of only 9,132 tons, or only 6.7 per cent. Excellent as consumption has been, production, stimulated by optimism regarding the ever-extending use of tin and the favourable market quotations ruling during 1928 and a great part of 1929, was unduly speeded up and heavy stock accumulations have resulted. Continental demand has been good and shows an increase of nearly 20 per cent. Large purchases were made by Russia, whilst in this country the tinplate works have been busy and output is above the previous year's level. In the United States, too, the demand for tin was fully up to expectations for the first three quarters of the year, both from the tinplate manufacturers and the bearing-metal trades, but since the Wall Street slump consumption has fallen away.

Considerable interest has naturally been aroused by the formation of a tin-producer's association, but it may as well be admitted that up to the present there has been but little faith in the ability of this body to modify the present state of affairs. In the first place, their idea was apparently to check smelter production, but since this gave no guarantee that reserves of ore would be held in check, the scheme was changed in favour of curtailment of mine output. Authentic news regarding the deliberations and intentions of the association have all along been difficult to obtain, but it seems to be fairly certain that Dutch interests are inclined to come in, and now that the association of producers is not limited to British companies the scheme can be expected to be effective. Should a programme of partial restriction of output be adopted by the group as at present constituted, doubtless those interests not included would take full advantage of the umbrella thus held over them, and with some appreciation of the quotation consequent upon a reduction in stocks, their position would be a decidedly favourable one.

The formation of an association to exert an influence in the direction of a wider use of tin was applauded by all, for in increased consumption lies the cure for the present troubles in the tin market, but when rumours of output restriction began to gather strength the idea waned in popularity, and many opposed it

strongly. Reference has already been made to speculation and manipulation of tin values, and it hoped that as the sole aim of the Producers' Association is to stabilise prices of the metal at a reasonable figure, will put an end to this—once and for all. The year closed with more cheerfulness on account of the decision to adopt week-end closing of the mines, but it remains to be seen whether the scheme will not be defeated and consumers throughout the world harassed by "price pushing" on the London Metal Exchange. Herein lies one of the chief difficulties of the tin situation, and it is not wonderful that both producers and consumers are frequently inclined to call down curses upon the heads of operators on the Metal Exchange, for artificial fluctuations play havoc with normal trading. At its year end level tin is certainly decidedly interesting and for a long shot ought to show a useful profit.

The Position of the Lead Market.

Lead was perhaps the most stable of the non-ferrous metal group in 1929, for at the end of the year it was not a great deal lower than at the beginning, and, apart from a quick run up in March when £30 was touched in sympathy with somewhat highly-coloured reports from America and was followed by an almost equally rapid decline, this metal has held on a remarkably level keel. In the concluding months of the year the acute weakness of spelter dragged down the lead price, but by December 31 the spread between these two metals had widened much more than it was at the end of October. Production of lead has undoubtedly been heavy, and accumulation of stocks in America have caused anxiety during the second half of the year that has just closed, but the strength of the London market in the face of this adverse factor has been very satisfactory and gives ground for moderate optimism in 1930.

Consumption in Britain throughout the year was excellent, and stocks in official warehouses at the end of November were negligible and very much lower than at the beginning of 1929. Manufacturers of lead pipe, sheet and general products were busy, and no doubt the steady course of lead prices has been all in favour of steady consumption. Perhaps the cable makers have hardly taken so much lead as in 1928, but the falling-off has not been serious and the outlook for this year is favourable in this direction. The demand for English lead has been well sustained, and makers have been very well occupied, while exports were quite up to average. A disappointment last year was Germany's failure to approach her 1928 level and during the last six months the falling-off was very marked. Unfortunately, there are as yet no sign of any improvement there, and it seems useless to expect any speeding up of consumption, for the outlook is not at all cheering.

During the first half of last year rumour was busy regarding the likelihood of some arrangement being concluded upon the difficult problem of marketing lead in Europe, for in the past competition has often spoiled the picture from the producers' point of view. Burma, Mexico, Canada, Australia all have their separate problems, and it has always seemed impossible to reconcile these varying interests, but after many asservations and contradictions it was finally announced that an agreement regarding the marketing of lead had been reached, and although latterly there have been suggestions that maintenance of the price is presenting a good deal of difficulty, there does not seem to be much likelihood of a serious fall in the price. On the whole, the auguries for lead during 1930 are favourable.

Conditions of the Spelter Markets.

If lead was one of the most stable of the non-ferrous group last year the same cannot be said for its near neighbour spelter, which after opening at about £27 and climbing to £30 in March, finished the year at £19 12s. 6d., and at the time of writing looks very much as if it might go lower still. During the January to July period the outlook for spelter was not unfavourable, for reaction from the high level touched in March was inevitable, and hopes were centred upon the ability of the Zinc Cartel to hold the price somewhere near the level of £28 at which it had been "tipped" for stabilisation. From January 1 a cut of 10 per cent. in European production had been instituted, but as the year went on stocks showed unmistakable signs of accumulating in Europe and it became evident that the basis upon which the curtailment programme was based must have been at fault. This was, in fact, the case, and the output of spelter has in most cases during 1929 exceeded the 1928 totals.

August may be taken as the turning point in the fortunes of spelter last year, for from that month onwards the decline was rather rapid and the price went below £20 early in December, although this was followed by a slight recovery. Lower prices during the second half of the year did nothing to stimulate consumption, for buyers naturally adopted a very cautious attitude, but during late November and December manufacturers purchased fairly freely for the first quarter of this year and even beyond. The American situation did nothing to help London, for stocks increased steadily, the quotation fell away and all reports of a curtailment in output lacked confirmation. Truth to tell, the whole question of curtailment of spelter production is difficult, for in so many instances is this metal made available, more or less as a by-product, that the problem becomes very involved.

An announcement made in November to the effect that the Zinc Cartel would be dissolved at December 31 was not altogether unexpected, but it had the effect of depressing the market still further and low prices have not yet exercised that salutary check on production which they must eventually do. There are already signs, however, that the output of spelter will be curtailed, not artificially as in 1929 but through the all-compelling force of economic factors. In this way the present year will make a better showing than its predecessor, for artificial control having failed it remains to be seen what the less spectacular but more efficient curb of a low price will do.

As already mentioned, the consumption of spelter has not been good of late, and the serious falling away in demand from the galvanising trade during 1929 was a great disappointment. Export figures show that the 1929 overseas trade was about equal to 1928, but the galvanising industry at home did very badly and their purchase orders for spelter were keenly competed for. Business in zinc sheets was only moderately good. Demand from brass makers as in previous years was almost entirely restricted to high-grade quality and has been, perhaps, the best feature of the situation, although buying was at times rather erratic. In this connection it is interesting to note that galvanisers are turning their attention more and more to the employment of "best spelter," and during the course of last year fresh brands were added to those already in common use. Post-war development in spelter production have been all in the direction of the electrolytic process, and there can be little doubt that the next few years will show a big advance in this operation.

Agricultural & General Engineers, Limited.—The annual meeting was held in London recently, MR. G. E. ROWLAND (chairman), who presided, said that generally it could be stated that the concern recovered last year from the set-back that followed the coal stoppage of 1926, and that the progress prior to that date had been resumed. The future prospects of the company—given normal industrial conditions—were favourable. The export sales organisation was now in full operation. Their overseas branches in Argentina, Chile, India, Australia and Africa were making satisfactory progress, and a branch in New Zealand would be opened this month.

Pittsburgh and the U.S. Steel Industry.

Movement to the West.

Commenting on the large expansion programme of the United States Steel Corporation in the West, a writer in the "Iron Trade Review" says that the recent and prospective programme of construction in the Pittsburgh district contemplates no such extensive expansion of open-hearth and Bessemer capacity, but the replacement of old equipment will result in an improved efficiency, the net result of which means increased capacity. With the westward movement of population, economy naturally has dictated that producers keep adjacent to their consumers. There is no question, however, that the Pittsburgh district mills, because of their location with respect to coal and the rivers—the latter cheap mediums for transporting fuel from mines to mills—are firmly established and will continue to grow apace with the expansion in worldwide requirements of steel. As the United States develops to the west, Pittsburgh's percentage of total steel production of the country may be expected to decline slightly, but the date of its eclipse as the steel centre of the United States appears far deferred.

Pittsburgh's industrial expansion during the past 50 years largely has been the result of growth from within rather than from the introduction of new industries. The 1927 census of manufactures made by the Government shows that from 1880 to that year the number of industrial establishments in Allegheny county increased from 1,895 to 1,912, a gain of only eight-tenths of 1 per cent., but that during the same period the number of employees per plant rose 208 per cent. and the average annual wage increased 234 per cent., or from $454 to $1,520. At the same time, the average value of manufacturing output per plant gained 1,032 per cent., reflecting the use of improved methods and machinery.

In this growth the steel industry has played a prominent part. Of the $1,525,706,000 industrial output of Allegheny county for 1928, metal and metal products accounted for $1,139,895,600, or 74 per cent.

Contracts Open.

Dunedin, February 1.—Two centrifugal pumps, for the Dunedin Drainage and Sewerage Board. The Department of Overseas Trade. (Reference A.X. 8,961.)

Folkestone, February 1.—Cast-iron goods, for the Corporation. Mr. A. E. Nichols, borough engineer, Municipal Offices, Folkestone.

Kovno, January 16.—100 tons of hematite pig-iron, for the Lithuanian Railway Administration. The Department of Overseas Trade. (Reference A.X. 8973.)

Liverpool, January 23.—Steel sheets, wrought iron, and iron castings, for the Corporation. The General Manager, Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool.

Stamboul.—Cast-iron pipes, etc., for the Administration Générale des Chemin de fer et des Ports d'Etat. The Department of Overseas Trade. (Reference A.X. 8,922.)

Wellington, N.Z., January 28.—7½-ton overhead travelling crane, for the New Zealand Public Works Department. The Department of Overseas Trade. (Reference A.X. 8,959.)

WITH THE OBJECT of improving the facilities to shippers of iron and steel to the Birmingham district, a scheme was adopted at a conference in London of the principal regular lines engaged in the Anglo-Belgian trade. Uniform booking arrangements will immediately be in operation, which will facilitate the shipment of iron and steel, etc., from Antwerp and Ghent destined for the Birmingham district *via* London and South Wales. Traffic booked by any of the lines included in the scheme can now be transferred under a booking contract to any of the operating companies on a pro-rata basis. These arrangements will result in greater regularity of sailings, and delays in shipment will be avoided.

High Test Cast Iron.*

By O. Smalley, New York, N.Y.

High test cast irons come about from a number of contributary causes. Among these are:—

(1) The latent and undeveloped possibilities of this "cheapest of alloys" (cast iron);

(2) The unreliability of common cast iron under severe service conditions in engineering instruction where close factors of safety are necessary;

(3) The necessity of lifting grey cast iron out of the common place and giving to the iron founder an opportunity to confer individually to his product, and

(4) The need of a weapon of defence and attack against the keen competition of steel castings, forgings and stampings.

Differences of opinion will be found as to which of these is the most important. It will be generally conceded, however, that while a buyer will be willing to pay more for improved or new properties, the ultimate price will reflect what these properties cost in competitive materials.

From the amount of technical publicity devoted to high test cast iron during the past few years, one would imagine that enormous strides had been made and that we were on the verge of a new era in grey cast iron. In actual fact, this is not so. High test cast iron is not new. Its progress has been slow. Most of the so-called "new" processes, although they show what is possible to be obtained from properly made or treated cast iron, have yet to establish themselves practically in the foundry and find their place in the competition of things.

Advances in Cupola Practice.

Perhaps the principal advances in cupola cast iron may be summarised as follow:—(1) New designs to effect better combustion and superheat the metal, and (2) use of more steel and scrap iron in the mixes. Also the introduction of alloys.

Despite these, however, the problem of producing consistently good ordinary grey iron castings, uniform in quality, is still with us, and there is yet much to be known about the physical properties. Apart from simple tests like tensile and hardness, founders are sadly lacking knowledge of those properties which differentiate one iron from another and which determine their true service value. This question of the average founder having problems in making good ordinary commercial castings of known physical attributes is specially mentioned, because if this is true of common grey iron, how much more difficult it is for the average founder to appreciate what is involved in the manufacture of high test cast irons, particularly as there are still many founders to-day who do not even recognise the fundamental importance of metallurgical knowledge and supervision.

Methods of Producing High Test Cast Iron.

Cupola-melted high test cast iron made under the various processes have the following features in common:—(1) Use of high percentage of steel or a lowered silicon content; (2) a lowered total carbon and phosphorus content; (3) superheating in melting, and (4) control of graphitisation by chemical composition or rate of cooling during solidification.

With reference to item 4, the higher the carbon content in grey cast iron, the greater the difficulty in controlling the form of the graphite and the grain matrix, both being equally important in the determination of the physical properties of any casting. On the other hand, the lower the total carbon, the more difficult it is to get uniform softness and homogeneity of structure.

The use of steel in the mix has for its object the control of total carbon and to obtain a pearlitic or sorbo-pearlitic matrix. It is to its ability to confer such a structural condition that high steel mixes owe their superior strength, density and hardness. It is for this same reason, however, that steel is a common cause of hard spots, brittleness and lack of uniform softness.

Superheating in melting is also generally recognised as exerting a similar effect to steel additions in refining the graphite flakes, and in increasing strength through assuring solution of the carbon as carbide rather than as graphite. In the writer's experience, however, these influences are secondary. The primary object of superheating steel-rich mixes is to obtain the necessary degree of heat to take care of the higher melting temperatures and lower fluidity of such irons and also to ensure thorough fluxing and cleansing of the molten iron.

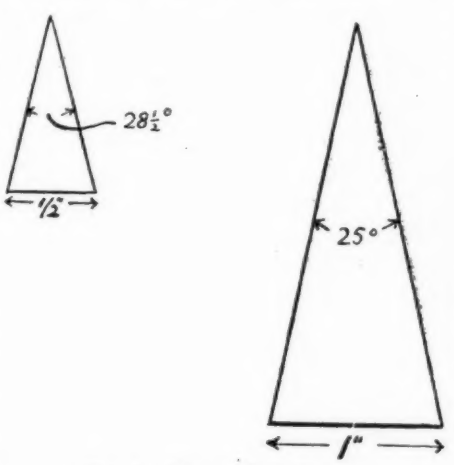

FIG. 1.—WEDGE TEST PIECES.

Having obtained the basic condition necessary to the superior physical properties of high test cast iron, viz., a carbide condition of the carbon, there still remains the problem of accurate and uniform decomposition of the carbide during solidification. It is in this respect where most new and patented processes find their application.

Of these processes, a practical, economical and effective method is that of Meehan's using calcium silicide. By introducing predetermined quantities of this alloy during the filling of the ladle, the carbide balance is disturbed to any desired degree, thus yielding uniform density, grain and softness, and precise control of the physical properties becomes possible.

An iron containing T.C. 2.8, Mn 0.6, S 0.1, P 0.18, and Si 1.2 per cent. was melted in the cupola in the ordinary way and consisted of 60 per cent. steel scrap, together with cast-iron scrap and sufficient high-silicon pig-iron to give the silicon content cited. Had this metal been poured direct from the cupola into the moulds, the resulting castings would have been uncertain in their test results. The smaller castings would have been white and brittle, while the heavier castings would have exhibited chilled edges and maybe cracks, and both the physical properties of machinability would have been uncertain. By the introduction of 120 ozs. of calcium silicide in the ladle as the metal filled it, sufficient combined carbon was graphitised so that the finished castings consisted wholly of a matrix of well-formed pearlite, while the primary and secondary graphite took a structural formation that affected but little the natural properties of the pearlite. This structural feature explains the high degree of toughness obtained from this casting. The physical test results obtained from standard test-bars were as shown in Table I:—

TABLE I.—*Properties of CaSi Treated C.T.*

Ultimate Strength, tons per sq. in...	20.9 to 22.8
Elongation, per cent.	0.05 to 1.0
Brinell Hardness Number	227–247
Transverse Strength, 1¼-in. dia, bar over 12-in. cent.	4,800 to 4,850
Deflection, in.	0.12 to 0.14

In ordinary practice the range of composition permissible varies according to the specific requirements of the castings to be made. Maybe among the unique features of high steel mixes using calcium silicide is that the silicon content of the iron need not be held within the strict limitations that are necessary to semi-steel mixes. It is, however, important to observe that within certain limits the steel content of the charge going into the cupola must be increased with the silicon content if high test results are required.

In an iron made from a 70 per cent. steel mix calculated to give 1.7 per cent. silicon, the chemical composition obtained in the finished casting was T.C. 2.81, Si 1.65, Mn 0.8, S 0.115 and P 0.185 per cent. One hundred ozs. of calcium silicide were used per ton of metal in the ladle. The physical test results were as shown in Table II:—

TABLE II.—*Properties of CaSi Treated Iron.*

Ultimate Strength, tons per sq. in... ..	20.5
Elongation, per cent.	0.5
Brinell Hardness Number	255
Transverse Strength, 1¼-in. dia. bar over 12-in. cent.	4,300
Deflection, in.	0.16

To measure graphitisation in the foundry and control so that a uniform structure and machinability are secured from the metal as it comes from the cupola irrespective of the quantity of steel used in the mix or of the silicon content, the author introduced the calcium silicide by means of a machine and took a chill and wedge test from each ladle of metal before casting. This machine is designed so as automatically to throw the alloy in the stream of metal as it fills the ladle, commencing as the metal is tapped and shutting off when the ladle is full. The quantity is changed by means of a switch operated by the cupola attendant. Each change has been worked out according to the class of casting to be made and the physical test results required. The chill test-piece is standard. This is run in conjunction with the wedge grain test. This latter is made in baked oil-sand mould. For light castings, a wedge of section No. 1 is used. For heavy castings No. 2 is used. The chill test wedges are as shown in Fig. 1.

By noting the fracture of this wedge immediately after casting a quick measure of graphitisation is possible from the depth of penetration of whiteness from the knife edge into the heavier section. Thus, if light castings of ¼-in. section down to ⅛-in. sections are to be poured and must be easily machinable, the knife edge must not chill to a depth of more than $\frac{1}{32}$ in. This standard set and controlled, one may be assured that all the castings made will be entirely free from chilled edges and will machine satisfactorily. Standards are set for castings according to their section, use and test results required. After experimenting together with long experience with the use of this wedge test-bar, it has been possible to correlate the quantity of steel scrap in the mix with the percentage of calcium silicide required to give the desired graphitisation to meet any specified test result and machinability.

To anyone unacquainted with this development and experienced only in grey iron, this control is difficult to appreciate, but a number of tonnage foundries having established this method

* A Paper presented at the Annual Meeting of the American Foundrymen's Association held in Chicago.

of control and their using it daily is proof that this is not merely a theoretical ideal. Actual experimenting by anyone interested will convince not only of the high activity and precise control possible by means of a calcium silicide as a graphitiser, but the problem of graphite in cast iron will assume a new aspect.

It is a peculiar fact that little or no calcium is left in the finished iron, while the silicon content increases are negligible and rarely exceed 0.1 per cent., although the calcium silicide alloy used contains 35 per cent. calcium and 58 per cent. silicon. Calcium silicide is exothermic in action and develops an intense local heat when it reaches the hot metal in the ladle. Its effect is gaseous; therefore, there is no chance of mechanical contamination.

Heat-Treatment.

The presence of coarse flakes of graphite and the instability of the carbide of ordinary grey cast irons are responsible for the difficulties and uncertain results obtained by heat-treatment or annealing, whether the desired object be to obtain greater strength, hardness, ductility or machinability. As is well known, the matrix of high steel mix cast iron compares with ordinary carbon tool steel; the essential difference between the two being the presence of graphite in varying amounts, depending upon the composition and the quantity of steel used in the cupola high steel mix. Commencing with a low graphite content and effecting control of its structural form and quantity by the amount of steel charged into the cupola, the temperature of melting and a predetermined calcium silicide addition, the resulting casting presents a base structure that compares with ordinary carbon tool steel, which may be hardened by rapid cooling from above the critical change point and softened by prolonged cooling at or about the Ar point. These changes in the hardening carbide of steel rich mixes obviously affect the physical properties much in the same way as they affect the ordinary 0.9 per cent. carbon steel, which consists of a wholly pearlitic structure, but with the absence of graphite flakes.

The tensile strength of 0.9 per cent. carbon steel with this structure is 48 tons per sq. in. If reheated and allowed to cool very slowly in the furnace, the tensile strength falls to 37 tons per sq. in., but if it were heated to above the critical change point and allowed to cool in air, the tensile strength would be increased to 58 tons per sq. in. Similarly, if quenched in water from above the critical change point, it will be glass hard and Brinell 675, but if it were allowed to cool slowly, a Brinell hardness of 156 would be found.

High steel mixed cast iron is equally susceptible to these conditions of change by heating and cooling. By heating to above the critical change point and quenching, they may be made glass hard, and if cooled slowly, they will Brinell around 156. Similarly is the strength and toughness affected by the rate of cooling.

The influence of heat-treatment on the physical properties of a 60 per cent. steel mixed iron composed of T.C. 2.8, Si 1.20, Mn 0.6, S 0.1 and P 0.18 per cent. is shown in Table III.

Table III.—*Properties of Heat-Treated Cast Iron.*

Treatment—Heat to 895 deg. C. for 2 hrs. and Cooled in Air.	
Ultimate Strength, tons per sq. in. ..	42.4
Elongation, per cent.	Nil
Brinell Hardness Number	241
Transverse Strength, lbs.	6,500
Deflection, in.	0.31

The technique of manufacture of high steel mix irons responsive to heat-treatment to yield such high test results is somewhat involved, for apart from the difficulty of melting high steel mixtures, graphitisation must be conducted with considerable care and carried out to such a stage that heating for the purpose of hardening does not decompose any of the hardening carbide.

By again changing the degree of graphitisation and depending upon heat-treatment completely to dissociate the remaining carbide and allowed to cool slowly from between the temperatures of 840 deg. C. and 650 deg. C., the physical properties shown in Table IV were obtained from this iron.

Table IV.

Treatment—Annealed 20 hrs.. 870 deg. C. Cooled in Furnace.	
Ultimate Strength, tons per sq. in. ..	21.4
Elongation, per cent.	5.5
Brinell Hardness Number	140
Transverse Strength	4,500
Deflection, in.	0.78

Mass Effect.

To show the uniformity of section of the above material when cast in large masses, tensile tests were taken from the centre and edge of a 6-in. section with the following results:—Outside, 20.5 tons per sq. in., and centre, 19.4 tons per sq. in.

Cargo Fleet Iron and South Durham Steel and Iron.

Viscount Furness presided at the annual general meetings of the Cargo Fleet Iron Company, Limited, and the South Durham Steel & Iron Company, Limited, held at Middlesbrough on December 18. After reviewing the accounts of the two companies, the chairman said that he and his co-directors now looked with anxiety to the future of the iron and steel industry, as they felt that the proposals of the Government in regard to the coal industry for a reduction in working hours, the proposed levies and marketing schemes, could only have the effect of increasing the cost of coal delivered from their own collieries to the works. If these proposals were carried into law, the cost of production of steel would advance, and their capacity for competition be accordingly reduced. Any increase in the cost of coal would have a most serious influence upon the basic industries and only intensify their difficulties. It would also increase unemployment.

Perhaps the most serious proposal from the point of view of the iron and steel manufacturers was that collieries owned by composite concerns, supplying coal to their own works, should be subject to quota in any way, either as regards their outputs or by cash levies on output, especially if the levies imposed were to be used to enable foreign buyers to obtain coal cheaper than large home consumers, thus increasing their opportunities to compete with their iron and steel products in our home markets and abroad. In addition to the increase in costs resulting from the reduction in working hours and marketing schemes, if the outputs of their pits were reduced in consequence of quota, this would still further increase the cost, and it would be necessary for them to buy from outside sources the tonnage of coal by which their outputs had been reduced at prices which would in turn be based upon diminished outputs and reduced hours and probable levies imposed to subsidise coal for export.

The iron and steel trade was often criticised as being inefficient as compared with other countries, but actual comparison could not be made with any country in the world, because of the "open door" here, and the constant demands that had been made on our costs in the form of local rates, social services, taxation and reduced hours of work since the war. Other countries had not been compelled to submit to similar conditions. Again, the free importation of steel, which was responsible for many of the difficulties of the iron and steel trade, had never been faced, and imports of all classes of steel continued to be permitted from countries where wages were less, hours of work longer and the standard of living lower than would be accepted in this country. To enable them to compete under such conditions it would be necessary for every person employed in the industry, no matter in what capacity, to be very much more efficient than his foreign competitor, and for output per hour from the same plant and machinery to be much larger than in Continental works, a position clearly impossible of attainment.

The unsatisfactory condition of the iron and steel industry had been the subject of much examination. In 1916 a Board of Trade Committee inquired exhaustively into the conditions of the industry with a view to its post-war prospects, and by a majority report recommended safeguarding, drawing attention to the detrimental effect the importation of iron and steel would have if it were allowed free of duty, which had occurred. In 1925 an inquiry was undertaken by the Civil Research Committee of the Conservative Government, and, after a full hearing, the Prime Minister stated that he was unable to allow the iron and steel industry to apply for safeguarding owing to a political pledge which had been given at the previous election. Another inquiry of very great length was conducted by the Balfour Committee, and in its voluminous report reference was made, in considerable detail, to the serious plight of the iron and steel industry; but it failed to make any recommendations which would help to solve the difficulties. At the present time a Committee, appointed by the Government, was taking evidence, and every assistance was being given to it by the industry.

The trade did not desire Government interference, but merely asked for fair play as regards its foreign competitors. Many foreign markets were closed to us by high tariffs; new works were being built in Australia and South Africa. High tariffs existed in India for the protection of the native industry, and higher tariffs were being imposed in Australia. We must recognise the fact, as history showed, that wherever the necessary raw materials were commercially available in any part of the world, iron and steel would ultimately be manufactured for the purpose of supplying the home market, with the effect that such market was lost to us. Our own home market was becoming of increasing importance as time went on, and, unless this was secured to home-manufacturers as the basis of their operations, it was difficult to see how the industry was to be continued, even on its present basis, and make sufficient profits to keep pace with its foreign competitors.

The reports and accounts were unanimously adopted.

Tungsten Steels.

COMPOSITION AND HARDNESS.

According to an article in "Archiv für Das Eisenhuttenwesen," describing recent work carried out on a 0.3 per cent., oil-hardened, carbon steel, the presence of 1 per cent. of tungsten has no effect on the Brinell hardness. The greatest Brinell hardness (425) is obtained with a tungsten content of approximately 5 per cent.; at 10 per cent. the hardness falls to 343; with an additional 5 per cent. of tungsten the hardness increases to 401, and at 20 per cent. falls to 321. The same steel in the water-hardened condition, however, is hardened by the presence of 1 per cent. tungsten, and hardens progressively with tungsten additions up to 5 per cent., over which figure the hardness decreases with increasing tungsten content.

Experiments carried out on a 0.7 per cent. oil-hardened carbon steel containing varying percentages of tungsten showed that the presence of silicon lowered the Brinell hardness.

In a 1.1 per cent. oil-hardened carbon steel the Brinell hardness remained constant at 601 in steels containing from 5 to 15 per cent. of tungsten, and increased to 653 at 20 per cent. The Brinell hardness increases progressively in a 1.4 per cent. oil-hardened carbon steel, with increasing tungsten content up to 15 per cent., which hardness is maintained in a steel containing 20 per cent. tungsten.

In steels with higher tungsten contents good hardness values can be obtained at relatively low-quenching temperatures (750 to 800 deg. C.), and have the advantage of a greater hardening range.

Messrs. W. France, Fenwick & Company, Limited, London, have ordered another collier steamer, 285 ft. in length, from Messrs. R. & W. Hawthorn, Leslie & Company, Limited, Hebburn-on-Tyne, who have just launched the "Kirkwood," of 4,100 tons deadweight, for the same owners.

Nickel-Iron and Porosity.

EVIDENCE OF REDUCTION PRESENTED.

At the December meeting of the Lancashire Branch of the Institute of British Foundrymen, held at the Manchester College of Technology, DR. A. B. EVEREST, of London, gave a Paper upon "Nickel in the Iron Foundry," which was published in our issue last week. Mr. E. Longden, the Branch-President, was in the chair. In introducing the lecturer he said foundrymen who realised the complex nature of cast iron understood also how that complexity created difficulties for which the correct solution was not easily found. They were much indebted to the investigators who had added to their knowledge of cast-iron metallurgy. Among them was Dr. Everest, who, indeed, had become world-famous through the research work which he and his colleagues had carried through.

Nickel in Chill Castings.

The CHAIRMAN thought the members knew that the Holley carburettor was a particularly troublesome casting. The Holley Company cast it in metal moulds. It occurred to him that that was a case in which the use of nickel would be advantageous. He asked whether this had been applied to large castings such as machine tools, so as to give greater soundness, wearability and machinability.

A Satisfied Experimentalist.

MR. J. A. REYNOLDS said his company had adopted the method of adding nickel, and there was only one job in which they had not been quite successful. He had not yet heard of anyone who had been wholly successful with it. That was a large spur wheel, especially when of the type with "H" arms. The only ones that were perfectly satisfactory were oval arms, and were not particularly large. Dr. Everest's remarks about the "K" bars led him to think the trouble was not due to liquid shrinkage (or porosity). Even where the iron was of the correct type and was supplemented by nickel, trouble might be caused by the overheating of the sand in that corner in the "H" arm, which corresponded to the short narrow portion of sand which Dr. Everest referred to in the case of the "K" bar. Had Dr. Everest any further experience or had he heard of anyone who had solved completely the trouble with spur wheels? They themselves had almost reached perfection, but some inspectors were very exacting and unwilling to pass a casting in which they saw a little porosity.

Experiments with other Elements.

MR. S. G. SMITH said this lecture had dealt with subjects over which he (Mr. Smith) had lost many a night's sleep. Somewhere about 1912, a professor made a statement to the effect that to alloy other metals with cast iron was a form of doctoring. Personally he assumed rather a strong attitude at the time, and asked, "Would that hold good applied to steel?" Contrast that attitude with the position to-day. The use of other alloys with cast iron had made considerable headway, and he was convinced in that respect foundrymen were progressing on the right lines. He himself, fourteen or fifteen years ago, made some simple experiments with titanium and vanadium, and he had also used large quantities of ferro-manganese and silicon, not only with cupola-melted iron but also with direct iron from the blast furnace. The results had been encouraging but not in any way so conclusive as the research work using nickel.

The half-coupling casting shown on the screen reminded him of many troubles. It was as simple as a brick to mould—but had to be machined all over and bored out. Often the bore was examined with a magnifying glass. Such a casting might be rejected for a speck half as large as a pea on the outside or the inside. They heard now that by adding 2 per cent. of nickel the trouble could be eliminated. That was definite progress.

On the whole, the castings Dr. Everest had illustrated were on the light side. One had more trouble with chubby castings. For instance, the casting for a small steam chest for a turbine engine, which had a thickness of metal enclosed towards the centre by other cores. It became superheated. The part cited remained in the heated condition considerably longer than any other part, hence the metal had been drawn from it. Would the addition of nickel have the effect of equalising the cooling of the centre of that steam chest?

The piston was another case in which he assumed the use of nickel would be a remedy for trouble. He had had considerable experience in the making of pistons of all sorts of sizes. As Dr. Everest stated, there was a thin skirt and a thick body, a thick end, a thick boss. Invariably those bosses were porous, and if one tightened up the iron too much a hard skirt resulted. On many occasions he had purposely thickened up the skirt, involving turning off the extra metal. This was done to equalise the cooling of the casting; and to a certain extent he had been successful, but foundrymen would be relieved from a great amount of trouble if the remedy suggested was applicable in that case. If the beneficial effects of nickel addition were as stated, would the resultant casting be equal in all respects, and possess the advantages which were claimed for the Lanz pearlitic process?

Real Strength of Cast Iron.

The BRANCH-PRESIDENT made a sketch of the cross section of an oil-engine bedplate. He said this casting failed under service, and test-pieces were taken out at three places and tested. At A (the bottom of the crankshaft) the figures were 5 tons 15 cwts.; at B (inside), 6 tons 10 cwts.; at C (outside), 8 tons 5 cwts. The separately-cast test-bars usually gave 11½ tons. It was a striking illustration of the fact that a test-bar, cast as a separate bar, could never show the strength of a casting.

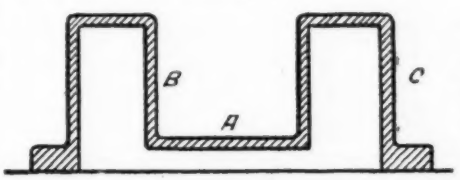

FIG. A.—OIL ENGINE BED-PLATE FROM WHICH TESTS WERE TAKEN.

MR. J. LOWE produced a casting and said these castings were machined on the bottom and machined on the top. They were put to a test for 24 hours, and if they leaked were scrapped. Would an improvement be made by adding nickel? If so, what percentage of nickel would Dr. Everest recommend?

Cost of Nickel Additions.

MR. J. MASTERS said from the foundryman's point of view the cost of nickel was an important factor. If engineers were to have better service, would they pay a little extra for their castings? At to-day's prices, the average jobbing foundryman could not make a living. Was it advisable to preheat the nickel before adding it to the metal in small quantity, say 1 to 2 per cent.? He quite appreciated the point Dr. Everest made that in big castings it was advisable to add the nickel in the cupola. Some time ago he had the pleasure of seeing in a local foundry a large casting which he believed had been made under Dr. Everest's personal supervision, as far as the melting and casting was concerned. From what he had heard since he understood that casting was a perfect success. Previous efforts had been more or less failures. Did the addition of nickel affect the resistance of the metal to acid corrosion? Quite recently a number of people had inquired as to a cast iron in that connection, and he had advocated the addition of 1.5 per cent. of nickel.

Losses in Alloying.

MR. E. FLOWER said he was not too concerned at the moment with the merits or demerits of the addition of nickel to cast iron. He was still groping about amongst the elementary stages, and was more concerned with the mode of adoption. He had discussed this subject with several foundrymen who had experimented, not from a laboratory point of view, but from a commercial one. Some time ago it was brought to his notice that a foundryman was endeavouring to make a casting, weighing round about 6 tons, with an addition of 2 per cent. nickel, which was added according to the method recommended by the lecturer, but on analysis the resultant cast only showed a trace of nickel. He did not know whether that was the fault of the foundryman, the method of adding, or the chemist, but it was a very serious proposition for any foundryman to encounter. Was Dr. Everest firmly convinced that nickel dropped into the molten metal directly it left the furnace was in perfect solution with that metal when that metal entered the ladle; if so, how did he account for the fact that the chemical analysis showed only a trace of nickel? If he was not convinced that this was so, did he think it feasible that owing to the commotion set up in the ladle by the metal entering, and the nickel not being in perfect solution with the iron at that period, that the nickel rose to the top and was absorbed by the slag?

MR. REYNOLDS said in experimenting they found it rather difficult to get the nickel to go down below the stream; slag and other material entangled the nickel. They overcame the difficulty by melting in the crucible. They determined beforehand the amount that was wanted. Crucibles and ladles were numbered. Some slight increase in cost was caused by the melting in the crucible, but that was largely recouped by the fact that they could guarantee the correct amount of nickel went into the metal without loss.

Gear Wheels and Rope Pulleys.

MR. A. SUTCLIFFE said a slide showed a gear wheel cut from a blank. He had not found a man who overcame the difficulty of sponginess either in gear wheels or rope pulleys. He would like to know how much was cut off in the case cited to ascertain if it was solid in front of the arms. These were only small wheels, so the sponginess is not so great as in large wheels and rope pulleys.

Nickeliferous Pig-Iron Additions.

MR. J. S. GLEN PRIMROSE said that the author had put before them a very clear case for the advantages of using nickel in cast iron, but he considered Dr. Everest was too modest when he said he did not know the reason for the improvement this addition brought about. It was fairly evident from the microstructure of the resulting metal, which the author had not shown them by lantern slide, although he had done so in his other Papers, that the reason was most likely to be found in the two chief constituents—namely, fine-grained pearlitic ground mass in which was embedded curly flakes of small-sized graphite. This degree of refining in the structure of cast iron could be brought about apparently by the use of metallic nickel additions to the ladle, but early experiments he had tried were with the inclusion of definite amounts of Mayari pig-iron to the charge. This added both nickel and chromium to the resulting metal, with highly beneficial results with quite small per-

centages, and there was no doubt about the homogeneity of the mixture. He thought the microstructure afforded a complete explanation of the improvements recorded by the lecturer.

MR. A. JACKSON said Dr. Everest had not touched upon one or two things, information about which would be very helpful to the ordinary foundryman. What would be added to the cost of the iron by using, say, 3 per cent. of nickel? Many firms might be tempted to try nickel if they knew where they could get small quantities of shot to try on a casting without incurring too much expense, which might not be remunerative. In iron used with nickel the silicon content was generally about 1 to 1.5 per cent. Would it be better to reduce the silicon content in cases where, say, 2 to 2.5 per cent. of silicon was used? He observed that sulphur was about 0.1 per cent. That was high for ordinary iron. Was it necessary to have a high sulphur content? Also the phosphorus, ranging about 0.1 per cent., was very low for ordinary iron.

MR. SMITH said he could show actual castings where the addition of a densener had thoroughly eliminated "draw"; he could also speak of many castings where it had not had that effect, as stated by the lecturer. In some cases it drove the draw further in. In a very heavy section the draw was not actually cured unless the densener was sufficiently heavy to carry it through. He could produce castings which showed conclusively the effect of a densener upon comparatively small chubby castings.

A MEMBER asked whether there was the same necessity of feeding castings when nickel was added.

AUTHOR'S REPLY.

DR. EVEREST said he entirely agreed with the Chairman's suggestion that in the manufacture of such articles as the Holley carburettor the annealing process could be eliminated by the use of nickel additions in the iron. Two London firms were using nickel extensively in castings of that thin section type, such as switch covers, where the section was a tenth to a twelfth of an inch thick. About 3 per cent. nickel was used, and the castings were not annealed afterwards, being perfectly machinable as cast.

Machine-tool castings was a class of work he had not as yet handled. As yet the matter had not been investigated extensively, but he knew that benefit was derived in the way of getting improved wearing qualities on such castings as lathe beds. More interest was being taken in this field in the United States than in this country.

A great deal had been said about porosity. His own opinion was that by using denseners porosity was often not eliminated, but was simply driven to other parts of the casting. The chill induced a harder quality of metal than there would be without it; that harder metal would tend to draw more than metal in the ordinary condition.

Effect of Nickel on Structure.

Mr. Longden had given a sketch of a part which had been cast entirely in chills. Had he examined that metal under the microscope? He (Dr. Everest) had had experience of iron cast under such extraordinary thermal conditions, and had found that the product was not ordinary iron at all; the ordinary pearlite-graphite structure in the iron had been entirely replaced by a structure of ferrite and graphite. In this connection also, in centrifugal castings, he found that against the chill, where one would expect hard iron, often little soft rosettes of ferrite-graphite were found. He assured Mr. Longden, however, that under the special conditions mentioned the iron was structurally so far removed from ordinary cast iron that the usual arguments concerning porosity did not hold good.

Mr. Reynolds had mentioned H-arms in gear wheels. A firm in the North had trouble with porosity in gear wheels. They adopted nickel with such success in the elimination of porosity that they acquired a reputation and built up an extensive outside business in supplying gear blanks. That business was still developing. With regard to the H-arms, he thought overheating of sand in the corners of the section would induce the porosity to take the form of a gas hole, passing through the skin of the iron in the corner. The addition of nickel would reduce that trouble, because it would reduce the general shrinkage of the whole casting. The H-arm section could not be blamed for causing this trouble.

Nickel Additions Excellent Yield.

It had been suggested that nickel was lost when making additions to cast iron. That was contrary to all his experience and that of all other investigators. Nickel was not only the least oxidisable metal; it was also the metal which alloyed most rapidly and readily in the final casting and was the least ready to segregate. In steel castings, the conditions were similar to those in cast iron in many respects, and the records of the Iron and Steel Institute showed that nickel was the metal which demonstrated the least tendency to segregate, nor was it lost on remelting. So he thought in the case mentioned by Mr. Flower there was perhaps something wrong in the chemical analysis, or that the nickel had been dropped into and become entangled with the slag. By using the nickel in the form of suitable shot, all of it could be got into solution in clean iron without any trouble. The results he had given were based on experiments superintended by himself, which were carried out very definitely on a practical scale and all in ordinary foundries. He had cast as much as ten tons of alloyed iron in one afternoon.

Chubby Castings.

He believed nickel was going to be very helpful there in eliminating the usual trouble of porosity in the bosses of couplings. Chubby castings were mentioned by Mr. Smith. Such things as small ingot moulds and moulds for die-casting machines and locomotive cylinder covers were castings which, to his mind, came under the heading of "chubby." Suppose a cover was an inch thick and had a block attached to it, 3-in. cube. That was a chubby casting. Another example was given by Diesel engine fuel-valve bodies, which were cast about 3 in. in dia., and after being machined and bored out, were subjected to a pressure-test of 3,000 to 4,000 lbs. per sq. in. He knew similarly of a case where the use of nickel made it possible to cast large plates, 6 in. thick by about 15 in. sq. These plates were subsequently machine-bored out for hydraulic gear, and were then subjected to a pressure test of 4,000 lbs. per sq. in. That iron was cast under normal conditions.

He was asked whether he could guarantee a cure for porosity in a particular casting. It was difficult to guarantee anything in cast iron and he did not know any test which enabled one readily to reach a definite conclusion on the point. His remarks on the elimination of porosity were based on extended practical experience rather than on a definite result obtained in any one casting.

Also, Mr. Smith raised the question of comparison with other processes, the results of using which were very similar to those obtained in some of these. Nickel, however, was not put forward in competition with these, but in many cases it was felt that there were definite prospects of good results being obtained by the use of nickel in combination with some of these processes.

Composition for Varying Sectional Castings.

Mr. Lowe had produced a casting having bosses, about 1 in. in dia., attached to a wall of about $\frac{1}{8}$ in. thickness. He would recommend the following:—Si, about 1.4 to 1.6; Mn, about 0.7; P, less than 0.04; and Ni, 1.0 to 1.25 per cent.

Cost Considerations.

In replying to Mr. Masters' question about cost, Dr. Everest pointed out that it was outside the scope of the lecture. As a general rule, it was found when nickel was employed, the cost of the nickel added could be often entirely offset by the reduction of scrap or by the use of cheaper materials in the foundry, or by the elimination of trouble and defects of various kinds. He agreed with Mr. Masters that preheating was advisable when adding a small amount of nickel to a small quantity of iron. His own experience was that no trouble occurred except when working with very small quantities of iron. With small quantities the heat went so quickly that one could not afford to hold the metal even during the short time required for stirring. When dealing with a large quantity of iron, the churning action of the metal gave complete and satisfactory mixing, so that the trouble did not arise.

Corrosion of Nickel Iron.

He could not say much about corrosion. Tests which had been carried out showed that, when working in iron of the ordinary pearlite-graphite structure, the corrosion was practically constant. One thing that possibly controlled the rate of corrosion was the graphite size. If one was using alloy iron, thereby reducing the graphite size, one could expect perhaps a certain amount of increased resistance to corrosion. Actual chemical corrosion of the material was a very difficult thing to measure. Possibly a nickel chromium would be of some advantage from this point of view.

Mr. Sutcliffe raised the question of rope pulleys and gears. The firm he had mentioned, who were making gears for outside people, were producing them up to 5 ft. in dia. In those cases the ordinary machining allowances were made. In the case of big gears, up to an inch of metal was often machined off before cutting the teeth. In large spur gears they cut in up to an inch from the original cast surface; in particular cases it might be more. He had had no experience of rope pulleys.

Nickeliferous Pig-Iron.

Mayari iron had been mentioned, but he did not think it was fair to treat it as a means of adding nickel to cast iron. One started off with an analysis showing something like total carbon 4.3, manganese up to 1.5, low sulphur, low phosphorus, chromium 2 per cent., and nickel 1 per cent. The nickel-chromium ratio was wrong for most applications; and when this iron was used to try to get the nickel required, there was a preponderance of other elements, so that it was not possible to add sufficient of this iron to the charge. In such a case like that, the nickel was relatively a small constituent in the iron and not present in sufficient quantity to give a suitable means of adding it.

The question of feeding the castings was raised. He knew cases where the use of nickel eliminated the necessity of feeding by virtue of the fact that it eliminated the porosity, which was the chief trouble.

Gas Pipes across the Rhine.—An interesting engineering feat is reported from Germany in connection with the scheme for supplying cities with surplus coke-oven gas, which is being carried out by the Ruhr Gas Company. In order to carry out a recently secured contract for the supply of Cologne, a double line of 16-in. gas mains, nearly a third of a mile long, had to be laid across the Rhine at one of the busiest points of the river. After a month's preparatory organisation, the task of laying the pipes in the bed of the river was accomplished within seven hours. Previous to laying, the pipes had been placed on floats from either shore, and then welded, leaving a length of 100 yds. in mid-channel free. The final sections were then taken out on a barge, welded and lowered by a derrick into a trench dug in the river bed.

Electric Furnace Development.

COST CONSIDERATIONS.

At a joint meeting of the London Sections of the Institute of Metals and the Institute of British Foundrymen, over which Dr. W. S. Smith presided, an enlightening discussion followed the reading of a Paper on "Metal Melting by Electricity"* read by Mr. D. F. Campbell and Mr. W. S. Gifford.

DISCUSSION.

The CHAIRMAN said it was of particular interest that Prof. W. H. Merrett was present, for he had helped to make the furnace which Sir W. Roberts Austin had exhibited 35 years previously. It was of the Moissan type, with horizontal electrodes.

PROF. T. TURNER (Past-President of the Institute of Metals), commenting on the great development of electric furnaces during the last 25 or 30 years, said that the first great development from his particular point of view was the use of electricity for the production of aluminium. He had visited the furnaces used at Sheffield, and he remembered also that experiments were conducted at Ocker Hill, in South Staffordshire, the St. John de la Rey Company, of Brazil, having sent over a quantity of ore. It was interesting to learn that one of the largest if not *the* largest furnace for brass-melting was being erected at Birmingham. Those who had accompanied the party of British foundrymen and metallurgists who had visited Germany in September, 1929, and had inspected the Hirsch Copper and Brass Works near Berlin, had been impressed by the extent to which electricity was being used there. At that works they had seen a whole row of Ajax-Wyatt furnaces, comprising about a dozen, for melting brass; there were also large annealing furnaces heated electrically, and electricity was also used for annealing wire, which, as it was reeled off, passed between two points and was automatically annealed. With regard to the melting of iron and steel, he referred to the great development of the relatively small high-frequency furnaces, and said it appeared that there would be considerable applications of those in the near future.

DR. C. J. SMITHELLS was interested particularly in the authors' statement that they had been able to melt tungsten, and said that when they could melt it so that it was truly castable it would be interesting to find out what its properties were. At his works tungsten was melted every day, but it was always brittle and unworkable. They had tried melting it in a very high vacuum; indeed, they had melted one piece of tungsten in a vacuum 50 times, allowing it to freeze after each melt, with a view to making it ductile, but after that treatment it was no more ductile than it was at first. They melted tungsten in a copper crucible in the electric arc, the crucible being water-cooled. They could fuse the tungsten so that it ran into a molten globule, and then it sat down on the copper and froze. It was interesting to note, however, that it could be melted at a temperature of over 3,000 deg. in a copper crucible having a melting point of about 1,000 deg. without melting the crucible. In an induction furnace they had melted molybdenum, which had a melting point of about 500 deg. lower than that of tungsten. The difficulty, of course, was to find a refractory which would withstand the high temperatures necessary for the melting of these metals.

PROF. MERRETT said he had had no practical experience of high-frequency furnaces. In 1921 he had written to Prof. Stansfield, of McGill University, who had strongly advised the installation of a special plant at the Royal School of Mines, but Prof. Sir Harold Carpenter had thought that the money might be better applied in some other direction—and so it was. More recently, however, the matter had again been raised—hence his interest in the Paper by Mr. Campbell and Mr. Gifford—and no doubt there would be some really good equipment at the school before long.

Melting Losses are Low.

MR. W. A. C. NEWMAN said he had not had actual experience of the use of a high-frequency furnace, but had used a 3-cwt. arc furnace, of the Ajax Northrup type. One of the metals melted in it was a bronze, containing 1½ per cent. of copper and 1½ per cent. of zinc, and the average loss sustained over a long period was about 0.4 per cent. With heating by radiation from the roof of the furnace, he did not think that loss was excessive. An important advantage of electric melting was the absence of noise and other inconveniences which were associated with ordinary coke and gas firing, and it seemed to him that such factors were not taken into account sufficiently; they had quite a detrimental effect upon the workmen. A question of great importance in this country was that of the cost of electric power. We were told that the operation of the new grid scheme for distributing electrical power would even matters up a little, but would not necessarily decrease the cost of power very much. In this connection it was interesting to note that the Hirsch works, in Germany, at which electricity was used so extensively, obtained power from a fuel-fired power station, so that the conditions with regard to the generation of power there were equivalent to those obtaining in this country, in that it was not generated cheaply by means of water power. By far-sightedness in the installation of plant which would consume a large quantity of power, they had been able to come to an arrangement with the power company for obtaining a supply at a very low price.

DR. CULLEN (President of the Institute of Mining and Metallurgy) also emphasised the importance of securing a supply of electric power at an economic price, a matter which was sometimes lost sight of in discussions on electro-metallurgy. He had visited the works of the Hirsch Company, and, although he could not state the exact price they paid for their power, he could say quite safely that it was about one-third the price of the cheapest power in England to-day. He had seen electric furnaces in operation in many works in this country and on the Continent, and one could not help admitting that there were outstanding advantages to be gained by their use, from the point of view of the quality of the metals and alloys produced. But did those outstanding advantages really neutralise the economics of the process? He suggested, with all humility, that the authors of the Paper had not paid sufficient attention to that matter; they had convinced their audience as to the merits of the process technically, but it was of no use embarking on schemes such as they had outlined unless one was quite sure that economically they were sound. He was connected officially with a scheme whereby some 50,000 or 60,000 h.p. was available in this country, at a cost to the consumers—after making allowance for interest, depreciation, income tax, rates and all other charges—of 0.17d. per unit. That was an extraordinarily low price for electricity in this country, though a good deal higher than that at which power could be obtained in many places abroad; there were places abroad at which power could be obtained at a price even as low as half the figure he had mentioned. He asked if the authors could think of any scheme whereby the power at 0.17d. could be used in a rather remote part of the country.

Melting Aluminium.

MR. VERDON CUTTS agreed that the low-frequency induction type furnace was an ideal medium for the melting of yellow brass under conditions involving a constant supply of a uniform alloy, but he asked how the authors would propose to cater for the conditions prevailing in some foundries, where the alloy was frequently changed, because there must always be a nucleus of molten metal to form the secondary of the circuit. He was interested to hear that the low-frequency induction type of furnace was being developed for dealing with the red brasses and copper and the higher melting point and higher conductivity metals, and would be glad of further information concerning the practical application of that type of furnace to the treatment of such metals and alloys.

He had been concerned with electric furnaces for 26 years, and had installed them for melting aluminium, and also a 200-kw. furnace for the refining of aluminium, and he considered that the best furnace for that purpose was that which employed the granular carbons in a silicon-carbide trough—with the development of which he had been associated for a good many years. With regard to the precious metals, he said he believed that for gold the high-frequency induction furnace was quite good. The last occasion on which he had seen one of his furnaces dealing with gold was one on which there was £126,000 worth of gold in the molten bath.

MR. H. J. MAYBURY said he had used hollow Soderberg electrodes of a diameter of about 4 ft. 6 in. or 5 ft. for melting aluminium. These had to be hollowed in order to cool the outside, but he had found that in practice the size of the hole had to be varied at the different stages of the process. That had caused a great deal of trouble, and he asked if there were any later developments.

A speaker asked if the high-frequency induction furnaces relied on the agency of hysteresis or induced eddy currents into the metal itself for melting it?

AUTHOR'S REPLY.

MR. CAMPBELL replied to the discussion. In a reference to Héroult, he said he was responsible for giving us aluminium as a commercial metal and also for giving us the first carbide of calcium, the first ferro-chrome and the first electric steel furnace. He was a very fine engineer. Mr. Campbell added that he had for a long time co-operated with Héroult, one of whose rules was that with arc furnaces one should never make an experiment at less than about 200 h.p., and that was a very good rule. The arc furnace did not lend itself to small-scale experiments, but the high-frequency furnace did. With an arc furnace, when used for experiments, one heated a number of bricks, a little metal and a quantity of slag, and it was difficult to pour good ingots on the small scale.

Commenting on Mr. Newman's remarks concerning the losses in the melting of non-ferrous metals in arc furnaces, he said that he had intended to convey, in the Paper, that the principle of the arc was not really satisfactory for melting the high-zinc alloys. Mr. Newman had been speaking of metals containing about 1½ per cent. of zinc, but the authors, when discussing metal losses, had in mind metals containing 30 or 40 per cent. of zinc. Zinc was very troublesome in arc furnaces; it entered between the bricks and caused short-circuits, quite apart from the losses of metal in the arc furnace; there was no question that the induction furnace was infinitely better, apart from the fact that its power consumption was very much less. Replying to the point made by Mr. Verdon Cutts as to the necessity for having a nucleus of molten metal remaining in the induction furnace, and the question as to what he

* See our issue December 26, 1929, page 453.

would do if he had to melt different non-ferrous metals from time to time, he said his advice would be to buy a cheap gas-fired furnace for very intermittent and varied work. At the same time, he pointed out that there were 50 induction furnaces working in the United States intermittently, *i.e.*, for nine hours per day, so that one must not exaggerate the difficulty of changing the composition of the charges. Dealing with the request for more information concerning the use of the Ajax-Wyatt induction furnaces for melting red brass, he said the new method of making the linings by the so-called Rohn process represented a very great advance, because one could make linings of highly siliceous material, pure alumina and other materials to withstand the action of such metals.

The problem of Soderberg electrodes for aluminium furnaces he was not prepared to discuss. He had been speaking entirely of the Soderberg electrodes in furnaces for steel, carbide and ferro-alloys; in all those cases the electrode was a solid cylinder, and there had been no general attempt to use a hollow electrode.

He agreed that in the high-frequency furnace the metal was melted by eddy currents in the manner described by the last speaker in the discussion.

Cost of Electricity.

Commenting on Dr. Cullen's remarks concerning the price of electricity in this country and abroad, he said that the price paid by the Hirch Company was 0.2d. per unit at night and 0.3d. per unit during the day. That low price was based on a good load and power factors; moreover, there were condensers for correcting the power factor. The company had made a good contract, and many undertakings in this country made the mistake of failing to offer similar inducements, and consumers did not always understand the importance of power factor and load factor. The fact that there was a special night-load rate at the Hirsch works was important, and Mr. Campbell urged that if annealing or other processes which did not involve the employment of much labour were carried out at night, so much the better, because by reason of the night load the price of electricity could be reduced. At the same time, he did not believe in carrying out at night processes which involved the employment of much labour, in order to obtain electricity at a cheaper rate, because the men did not work so well at night. The actual price of power in England was a matter which too few people seemed to understand. Some furnaces, 105 ft. long, had recently been built at Stoke-on-Trent for colouring pottery; the load factor there was over 88 per cent., the power factor was very high—almost unity—and the cost of power was 0.375d. per unit, which compared with the figures of 0.2d. and 0.3d. at the Hirsch Company's works. That was an example of how a satisfactory price could be arranged even in this country if the load factor and power factor were satisfactory. The furnace was at work every day and every night, including Sundays, and stopped only once a year, on the occasion of the annual holidays. The price in Birmingham for all approved electrical furnaces was 0.5d. per unit, which was subject to a slight increase in respect of coal, which might bring it up to something under 0.6d., or thereabouts; in Sheffield the price was very much the same, and some quite favourable contracts had also been made in the Newcastle district. Referring to Dr. Cullen's question with regard to a supply of power at 0.17d. per unit—this was on the west coast of Scotland—he said that before one could express an opinion one must know what were the conditions under which it could be supplied at that rate. It was often the basis of hydro-electric power contracts that the power must be paid for continuously day and night, including Sundays. In many circumstances it would be more advantageous to the user to pay 0.25d. per unit consumed, as measured by the meter, than to pay 0.17d. per unit for a given quantity, whether it was used or not. If he were melting brass electrically he would rather pay 0.5d. per unit for the actual power consumed, and know that he would not have to pay for power when the furnaces were stopped owing to bad trade or breakdowns, than enter into a contract for several years to pay 0.3d. per unit for a given quantity of power, whether he used it or not. If one were supplied with power on the latter basis one was running enormous trade risks, and that matter must be taken into account when comparing contracts made with fuel stations and those based on hydro-electric power. The former involves heavy running costs, which can be reduced during bad times, but the latter are based on enormous capital expenditure.

Replying to Mr. Cullen's question as to how many of the processes described in the Paper were commercially successful, he said that they were all commercially successful, except for two qualifications. In the first place, the commercial advantage or otherwise of melting aluminium by electricity was at present rather obscure; secondly, the remark he had made concerning tungsten was merely a passing observation and should not be regarded as of any importance.

Vote of Thanks.

MR. V. C. FAULKNER (Past President, Institute of British Foundrymen) proposed a hearty vote of thanks to the authors for their Paper, and asked the authors whether the 50-ton electric furnace which had been installed by Mr. Henry Ford some five years ago had been a success or not, because he had heard nothing further with regard to it. He also asked whether the furnaces for making iron from iron ore, and about which one had heard a great deal in the early days, were still being used successfully?

DR. SELIGMAN (President-Designate of the Institute of Metals), in seconding the vote of thanks, commended the practice, which had been followed by the London sections of the Institute of British Foundrymen and the Institute of Metals for some years, of holding joint meetings for the discussion of problems of mutual interest to members of both bodies. Finally, he paid a tribute to Mr. Campbell and Mr. Gifford for their Paper, which was one teeming with useful information. The vote of thanks was accorded with acclamation.

MR. CAMPBELL, after responding to the vote of thanks, said he had heard nothing recently about the large furnace installed by Mr. Ford, which was significant. With regard to the second question asked by Mr. Faulkner, he said the furnaces mentioned were working quite successfully in Sweden. Mr. Gifford had visited them a week or two previously.

MR. GIFFORD, who also responded, said he had seen recently several of the large furnaces referred to in Sweden, and they were all operating in a satisfactory manner. The conditions in Sweden, however, were entirely different from those obtaining in this country, because in Sweden electric power was cheap and coke was expensive, but one could not expect to smelt iron ore by electricity commercially in Great Britain.

Cleveland Bridge & Engineering Company, Limited.—MR. J. R. DIXON (chairman), presiding at the annual meeting of the Cleveland Bridge & Engineering Company, Limited, said that competition did not appear to have abated, and they had not booked the volume of work during the year which they had hoped for. An interesting job which they had nearly completed was the dismantling of the whole of the floor of the Zambesi Bridge, and the replacing with a new floor to take a roadway and footpath in addition to the railway. They had also booked an order for the steelwork for a new coal staith for the River Wear Commissioners. The company had been awarded a contract in Egypt for a bridge over the Nile at Edfina, competition for which had come from Germany, France, Belgium and Italy.

A Stainless Alloy.

"18 AND 8" CHROMIUM-NICKEL TYPE.

In the course of an article in a recent issue of "The Iron Age," MR. T. HOLLAND NELSON remarks that a very popular alloy at the moment is one known as the "18 and 8 type," signifying 18 per cent. chromium with 8 per cent. nickel. This metal can be cold-worked readily. Articles of extremely intricate design can be formed and fashioned from this alloy which it would be impossible to produce in a straight chrome material.

Like all other metals, these alloys become harder with continued cold work, which, of course, is reflected in an increase in the tensile strength and elastic limit, with a corresponding reduction in the elongation and reduction of area. A simple heat treatment, *i.e.*, rapidly heating to 1,900 to 2,000 deg. Fah., and either air-cooling or quenching according to section, will restore the original ductility of the annealed material.

Forging, Annealing and Pickling.

Chrome-nickel alloys of the "18 and 8" or similar type can be forged or rolled from a temperature of approximately 2,200 deg. Fah. down to about 1,700 deg. Fah. without difficulty. Working below this temperature is difficult and has a tendency to rupture, if not crack and burst, the material. Slow heating to approximately 1,500 deg. Fah. and then more rapid heating to maximum temperature is advised.

Being an austenitic alloy, the softest condition is obtained by heating the material to a temperature of from 1,900 to 2,100 deg. Fah., according to modifications in analysis, and cooling as rapidly as possible. Air-cooling on thin section is sufficient, but more massive sections would require quenching.

The method of pickling chrome-nickel alloys is substantially the same as that adopted with the straight chrome irons and steels, except that sand-blasting is not recommended to accelerate pickling, due to the fact that the material is so soft that the particles of sand readily become embedded in it. The general practice is to place the heat-treated material in a solution of hydrochloric acid, 20 to 40 per cent. acid, to which sometimes a smaller percentage of nitric acid is added, allow it to remain until the scale is removed, wash with water and immerse in a solution of nitric acid, 10 to 20 per cent., in water, with a final wash off in clear water. The temperature of the hydrochloric-acid bath can be raised with advantage to approximately 180 to 200 deg. Fah., and the material has a tendency to show a somewhat whiter surface if the subsequent immersions in nitric acid and final washing in water are also done hot.

Among the chief difficulties experienced in the foundry are the contraction on solidification and the rapidity with which the metal solidifies. The shrinkage of "18 and 8" material is approximately $\frac{3}{32}$ in., compared with $\frac{1}{8}$ in. per foot in the case of cast iron.

It is not easy to produce a perfectly satisfactory surface on a casting. Pickling is resorted to just as on the wrought material, but the surface indentations and imperfections on such a rough surface have a tendency to hold small particles of foreign matter. In the early stages these small imperfections or inclusions rust and stain quite a considerable area, but, as they are soluble in service under corrosive conditions they are gradually eliminated. It is almost impossible to obtain a finished pickled casting which does not show some corrosion pits.

MESSRS. SWINNEY BROS., LIMITED, Wansbeck Ironworks, Morpeth, have secured an order from the Tonsbergs Hvalfangeri, Tonsberg, Norway, to convert from coal burning to oil burning their batteries of steam boilers and guano dryers at their whaling factory in South Georgia.

High-Speed Melting in Cupola.

That the economic advantages of melting iron in a cupola at the best speed obtainable are evident to all foundrymen contended MR. W. N. TRUXELL, research engineer to the Potter Coal & Coke Company, Greensburg, Pa., in an address entitled "The Metallurgical Advantage of Higher Melting Speed," delivered at the December meeting of the Philadelphia Foundrymen's Association, Manufacturers Building, and published in the "Iron Age" of December 19, 1929.

Mr. Truxell said that the aim of most foundrymen is to melt iron at the cupola's rated speed or better, and he pronounced it his purpose to point out some not so obvious, but none the less real, advantages which follow such practice, properly carried out. His arguments and deductions on melting practice were collected from personal observation of over 200 foundries.

Average Cupola Operation only 75 per cent.

It has been found that the average cupola is operated at approximately 75 per cent. of its rated speed, although there are a few which are up to, and even higher than, the rated speed, while others are considerably below the average. To obtain extremely hot iron it has long been contended that speed necessarily must be reduced. It has certainly been learned that hot iron and rated speed can be obtained readily with the speed even increased.

When iron is melted slowly and at a high temperature, the charging of excessive coke is found to be the usual practice; but this term, excessive coke, requires some explanation. Most foundrymen think of coke weight as in ratio to iron rather than in comparison to air, so that, in the case of excessive coke and slow melting, one finds the hot area in the cupola limited in height and with poor conditions for combustion. Hot iron may be obtained this way, and it is being done quite frequently, although many other factors enter in. It is evident in these circumstances that the iron has quite a period of time and favourable opportunity to undergo changes, such as losing silicon and phosphorus and picking up carbon and sulphur. Careful comparisons, however, show that iron melted in this way will vary so greatly from the iron which is charged as to be almost unrecognisable.

Loss and Pick-up of Elements.

When a cupola is melting at capacity speed or better, that is, 10 tons an hour for a 10-ton cupola, and delivering equally hot metal, the difference between the analyses of metal charged and metal poured shows a likeness that encourages the melter in his conviction that he can deliver iron at the spout which will meet specifications. Many foundries are losing 0.20 to 0.25 per cent. silicon and phosphorus while picking up 0.10 per cent. sulphur, as compared to others with a silicon and phosphorus loss of 0.10 per cent. and a sulphur absorption of 0.05 per cent. It is rather significant that these figures vary directly with the melting speed.

As to the picking up of carbon, several large foundries are melting a high percentage of steel in an endeavour to obtain high tensile strength, aiming at low total carbon, and are obtaining 3 per cent. carbon and under regularly by operating at high speed. It should be sufficient to encourage small foundrymen to at least investigate the possibilities of their own melting equipment when one realises the high melting speeds maintained by our automobile foundries and the uniformity of their output.

Foundry cupolas, and also the method of their operation, vary to an almost unbelievable degree. The time is rapidly passing when every foundryman regards his cupola and foundry conditions unique. To-day, one realises that the cupola is no longer "she," but a piece of mechanical equipment, and therefore subject to the same laws of mechanics and physics.

A Composite Cupola Described.

Describing what he termed a composite cupola, Mr. Truxell declared that the composite average of American cupolas to-day, which are operating economically and efficiently, will be found to conform to the following general description:—

The height of the charging doors from the tuyeres is 13 to 15 ft. This height varies only as the size of the material to be charged and not with the diameter. The cupola which will carry eight charges to the charging door has been found to lie well within these dimensions and to operate ideally as regards blast-air pressure, sufficient stock being present to take advantage of the heat generated, and yet not excessive to the point of requiring additional blast pressure to penetrate the mass or to necessitate additional coke to replace fuel loss by premature burning high in the stack.

As regards the tuyeres, this composite cupola has its single continuous tuyeres with a height equal to one-twelfth of the diameter as lined. This height gives a tuyere ratio to the cupola of three to one, which, of course, in turn, gives a low blast pressure. A large majority of foundries are approximating this tuyere condition.

Referring to the crucible or reservoir at the cupola, there is a large variable due primarily to local conditions in jobbing foundries. The average, however, for an economical cupola melting hot iron is a crucible 12 in. high from sand bottom to tuyere.

In a cupola which conforms to these general specifications, operated with the correct amount of air, the melting zone will be found to extend to approximately 24 in. above the tuyeres, with its centre lying about 16 in. above them. The height of the melting zone will vary with the kind of coke used. A dense, heavy, slow-burning fuel tends to lower the zone. The ideal coke for fast melting should contain a high total carbon and a high percentage of volatile matter with an open structure. High-volatile properties mean easy ignition, particularly when in conjunction with an open structure permitting easy penetration of air.

In order to obtain the metallurgical advantage in melting, and more particularly in high-speed melting, it is necessary to maintain a clean cupola. Limestone, mentioned because of its almost universal use, charged on the coke in the ratio of one to four, and with a charge on the bed coke to start off, will flux the cupola cleanly and will not affect the lining unduly. Slag should be removed from the cupola, commencing at the time the third charge reaches the tap hole.

Discussion.

Following the general presentation of his subject, Mr. Truxell informally answered many questions, some of which are reviewed here. In making high-test iron, where charges in some cases consist of 100 per cent. steel scrap, some foundries have made iron with a carbon content as high as 3 per cent. Formerly a very hard, dense coke was regarded as the best, but in the speaker's opinion, a free-burning high-volatile coke is much better. So-called "silvery coke" is not now so highly thought of. A uniform charge in weight is recommended throughout.

That iron should be melted as hot as possible, no matter what kind of casting is to be poured, is the opinion of the speaker. Ingot moulds, thus made, will stand up 40 per cent. longer. The largest sanitary manufacturer in the country uses 72-in. cupolas and an air pressure of 7 in. Hot iron is poured continuously at the rate of 18 tons per hour.

Blowholes.

By NEVILLE DEANE.

Blowholes can be classified under at least five heads as follows:—(1) Metal cast too cold, (2) metal cast too hot, (3) sand of the mould too damp, (4) sand rammed too hard and (5) blowholes due to cores.

The holes in the first class are generally fairly large, not very numerous and rounded in appearance. Once the appearance has been noted in connection with the cause, future "cold" blowholes can be easily detected. The cure is obvious. The second group is remarkable for exactly the opposite aspect, the holes being small, numerous and jagged, often appearing somewhat like the effects of shrinkage. As they are distributed throughout the casting, however, it is obvious that they are not shrinkage cavities. The cure in this case is also obvious.

When the moulding sand is damp, the blowholes are nearly always on the top side of the casting, just under the skin, sometimes even the skin is missing or so thin that it breaks like an eggshell. There is also a considerable evolution of steam, which bubbles the metal in the gate, although when the gates are broken off any deductions which might be obtained from them cannot be made.

The fourth class are hardly blowholes in a strict sense, since they are usually merely depressions in the surface of the casting. The sand being rammed too hard does not allow the air and gases to pass through, and, consequently, the metal will not fill every contour of the mould as it should do. If the sand is also too damp blowholes of both the third and fouth groups will be present. It is often difficult to obtain the correct degree of moisture and hardness in the mould at the first attempt, and the correct gauging of these essentials is one of the points calling for the highest skill of the moulder.

Core Blows.

Blowholes due to cores are easy to detect, but not always easy to cure. They lie in the top side of the casting and are due to the gases from the burning core not being properly conducted by the core-vents to the outside of the mould. The most troublesome cores are probably those which are small in cross-sectional area compared with their length, placed upright in the mould and which should be covered with a thickness of metal—like a thimble. Such cores, if not made properly—and they may be green-sand cores left by the pattern itself—will invariably produce a blowhole on top of the core. It is quite useless to vent the top half of the mould, the core itself must be thoroughly well vented and the vents must have a clear exit to the outer air.

In some cases ordinary moulding sand simply cannot be made to give satisfactory results, in which cases cores of sea-sand and binder must be used, with discretion exercised as to the amount and kind of binder used in each case. After preliminary trials there is little excuse for blowholes due to cores, whilst those due to too wet sand and too hard-rammed moulds may always be a potential trouble.

There is another class of blowholes which is not included in the list, and these are due to the metal itself. Copper, silver, some gunmetals and various pure metals and alloys are occasionally met with, which appear to occlude a gas when molten and give it out when solidifying, so that no amount of skill on the part of the founder will prevent blowholes in the castings. Such metal must be re-melted, treated with a "scavenging" metal or alloy of a type to suit the defect involved, and is better cast into ingots for examination before being re-used.

XUM

The Production of Iron Castings for Enamelling.

By J. H. D. Bradshaw (Metallurgist, Bradley & Foster, Limited).

This class of casting is generally of a thin, ornamental nature, great strength not being required so much as a good clear impression of the mould. It will be realised, therefore, that the iron must be very fluid, and must be poured at a higher temperature than is usually necessary in general foundry work. It may be pointed out here that "bad castings" is the old reliable excuse of the enameller, when, apparently, no other reason can be found for the production of defective work. Although this is true in some cases, it is not always the case, and the following notes are written in the hope that they may assist other workers in the production of suitable castings.

Composition of Metal.

It is, of course, of primary importance to have the correct composition of metal in all foundry practice; the light castings section not being an exception to this universal rule. In fact, one may go so far as saying that the composition of the metal, for this class of work, is as important as the correct composition of the actual enamel, for the composition of both must go hand in hand. Should the composition of the metal vary greatly, then the coefficient of expansion will vary accordingly, possibly resulting in "crazing" or perhaps chipping of an enamel, which may be a really good and trustworthy one.

Experience and data to date suggest that the ideal iron for the purpose will contain:—Total carbon, 3.5 to 3.7; silicon, 2.50 to 3.0; manganese, 0.30 to 0.50; sulphur, 0.060 to 0.090, and phosphorus, 1.40 to 1.80 per cent.

Such an iron will have a cubical expansion of approximately 0.000033 per deg. C., and will give excellent results with most of the enamels on the market to-day. It is essential that the composition of the iron is such as to give a low coefficient of expansion, otherwise enamelling becomes difficult, and, at times, practically impossible. It is, of course, quite true that the expansion of the enamel may be varied by alteration of composition, but the ironfounder must also bear in mind that there are limitations in this direction.

In German and American practice there is a tendency to use irons containing less phosphorus and a higher manganese content than the usual English practice. These irons contain approximately 0.6 to 0.9 per cent. phosphorus, with a similar manganese content (0.6 to 0.9 per cent.). Most founders know that phosphorus produces a thinly fluid metal which will give a good mould impression, but excess should be avoided owing to its embrittling effect. Manganese also has an embrittling effect beyond a certain point, therefore it follows that with a high phosphorus content the manganese must be kept low, otherwise the combined embrittling effects of the two elements will become operative. This explains the fact that with the English irons, having a high phosphorus content (say 1.5 per cent.), the manganese must be kept very low (0.3 per cent.); on the other hand, Continental and American irons containing a lower amount of phosphorus (say 0.8 per cent.) may contain up to as much as 0.9 per cent. manganese without its embrittling effect being noticed. Should the silicon fall below 2.0 per cent. an embrittling effect will also be observed, due to the formation of iron carbide.

The mixture should not contain any steel scrap or bought cast-iron scrap; the former because of its diluting tendency, thereby raising the melting point of the metal, and the latter owing to its greatly varying nature. If economic considerations will allow, it is much better to use an all-pig or nearly all-pig mixture with a little, say 5 per cent., of one's own foundry scrap, the approximate composition of which is known. If it is remembered that the finished products are enamelled castings, the use of virgin iron of the composition indicated will more than make up its extra cost in other directions. Also, adherence to the composition indicated above will minimise the quantity of warped, crooked and broken castings, will result in smoother surfaces, and, further, will save expense in grinding, machine-shop labour and tools. If, owing to local or other conditions, it is found impossible to adhere strictly to the formula given, then by all means keep the silicon above 2.5 per cent., and tap the iron as hot as possible.

Patterns.

This type of casting usually calling for large numbers from each pattern, the latter are usually made of metal. Great care must be taken that the pattern is of uniform thickness, for, should it tend to thinness in places, chilling of the metal at these points is highly probable, resulting in what the enameller calls "hard areas," which are extremely difficult to enamel unless the casting is annealed. Hard areas, which have a strong tendency to occur on solid flat parts, such as stove doors, ends, tops, baths, sinks, etc., are extremely liable to crack when placed in the hot muffle furnace for the enamelling operation; therefore, if for this reason alone, founders should take every precaution that lies in their power for preventing them.

When designing or making patterns for castings to be finished by enamelling, it must be constantly borne in mind the fact that enamel will not adhere to a sharp edge or point; it will simply flow or "run away" from such edges, leaving them protruding through the enamel in a somewhat unpleasant manner. The writer knows of instances where numbers of patterns have had to be altered after large quantities of castings have been made from them, this point not being realised until the castings reached the enamelling shop, when all the sharp corners had to be filed off before the enamelling could be proceeded with. For this reason, then, sharp edges on corners, etc., should be eliminated as far as possible, and such places curved with a liberal radius.

Moulding.

The moulds are usually made in green sand, Belfast sand being used in many of the Scotch foundries with excellent results. The sand must be carefully selected in order to give the clean castings desired, and should be regularly tested to give uniform results. A good sand for the purpose will contain approximately 90 per cent. silica and 10 per cent. alumina. Should the sand contain over, say, 0.5 per cent. of lime it must be rejected by all means, owing to the power of even very small amounts of this material to produce rough castings. Similarly one containing an excessive amount of clay cannot be used, for it will also tend to produce roughness.

Facing sand should be carefully prepared, and an excess of coal dust avoided, because, if it becomes embedded in the pores of the casting, it is only with great difficulty removed, and if left, is very often the cause of blistering in the subsequent enamelling process. As a general rule the proportion adopted for giving good results is nine parts of old floor sand, five parts new sand and one part coal dust, the whole being thoroughly well mixed and sieved several times.

This point is of vital importance to the enameller, and it must be clearly understood that excess of coal dust in the facing sand must be avoided. For this reason other materials have been used for the production of a good facing sand.

Soapstone powder has been found a very satisfactory means of preventing the burning of the sand, thereby producing smooth castings without the use of the objectionable coal dust. It must, however, be used cautiously, for, being as weak as coal dust, it is liable to spoil the foundry sand by making it too weak. It is, presumably, well known that the coal dust does to some extent burn out, whereas the magnesia of the soapstone will not. Plumbago or graphite, sometimes used to give the casting a good surface, must be entirely avoided, because of the disadvantages mentioned above. The pattern should be placed in the sand with the face in the drag, that is, the surface to be enamelled is bottom when the metal is poured, in order that any slag or dirt carried into the casting will float, causing irregularities at the back of the casting. By this method a clear, smooth surface for enamelling is obtained.

Gates or Runners.

These should always be on the edge of the casting, not on the face. Some stove makers were very reluctant to make this change, but it must be clear to everyone that a gate or riser on the edge will eliminate blowholes, dirt and sand on the face that is to be enamelled. The gate should be as large as the side of the casting will allow; two or more gates should be added to the casting where necessary, so that the metal may run into the mould as quickly and hot as possible.

Pouring.

For casting purposes it is, indeed, a great advantage to have the moulds placed near the cupola, if at all possible, so that the metal may be poured with a minimum of delay. After pouring, the castings should be removed from the moulds as quickly as possible. If left in the sand small rust spots (known to the enameller as sand spots) appear, which seriously retard the adherence of the enamel in those places. The peculiarity of these rust spots is the persistence with which they continually reappear, even after a good sand-blasting or an insufficient anneal. So far as the author is aware, the only cure for this trouble is to give the castings a thoroughly good anneal, scrape the rust spots with a rough stone or file, followed by a thorough sand-blasting. This is, indeed, a case where "prevention is better than cure," and founders experiencing this kind of trouble will be well advised to have castings for enamelling removed from the sand *as quickly as possible*. Experience shows that this point is too often neglected in practice, and thereby entails considerable expenditure of time, fuel energy and temper in the enamelling department, with its consequent reduction in output.

Preparation of Castings for Enamelling.

All fins and gates should be "bobbed" in a careful and conscientious manner that will leave a continuity of contour without ridges or recesses. Lumps, scabs or other surface defects should also be lightly ground, and the disfiguring effect of sand or blowholes may also be minimised by a judicious use of the emery-wheel. It must be constantly borne in mind, however, that the enamel will follow the surface of the casting, and any defect, instead of being hidden (so frequently thought to be the case by many founders) will be carried through to the finished surface. This remark applies perhaps more forcibly to the modern liquid enamels, the coating of which is extremely thin when compared with the older "dusting" enamels.

Surfaces intended for enamelling should not be made too smooth by filing, grinding or polishing, as the enamel will not adhere to a smooth surface; besides, it is a waste of labour, because the smooth surface will be entirely destroyed by the subsequent sand-blasting. Neither should the castings be subjected to a "barrelling" operation, which also has a tendency to produce a smooth surface.

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The castings should be scrupulously clean, and, as suggested above, a slightly "etched" surface is the ideal one for enamelling purposes. Such a surface enables the enamel to obtain a good "grip" on the iron and to which it will hold most tenaciously. The cleaning is most effectively and economically accomplished by means of a good sand-blasting apparatus using a fairly coarse sand. This process of cleaning gives, in addition to a clear surface, the etched or slightly roughened surface so greatly desired by the enameller. The operation should be continued until a perfectly clean and "white" surface is obtained.

Metallic or hardened steel balls or shot should not be used as abrasives, owing to the tendency of such materials to "peen" the surface of the casting much more than sand, thereby not giving such a good surface for the successful adherence of the enamel. The use of acids for "pickling" or cleaning the iron has been attempted, but so far not attended with much success. Acids are extremely useful for the pickling and cleaning of steel wares for enamelling, but it must be remembered that cast iron is much more porous than steel, and will therefore absorb relatively large quantities of the acid. Upon heating in the muffle furnace to the enamelling temperature this absorbed acid will vaporise, resulting in a badly blistered enamelled surface. Another great disadvantage lies in the fact that the evolved acid fumes floating about in the furnace will attack the enamel and produce a dull or "pig-skinned" surface.

During the pickling process the effect of the acid is to dissolve some of the iron from the surface of the casting, with liberation of hydrogen. By this means some of the flakes of graphitic carbon, originally beneath the skin of the casting, are exposed. (This can easily be detected by drawing one's finger across the surface of a casting that has been pickled.) During the subsequent enamelling process this free carbon is therefore brought into direct contact with the enamel, and owing to its powerful chemical action at the existing temperature on some of the metallic oxides composing the enamel, will result in evolution of carbonic oxide and subsequent production of an ugly blistered surface.

Coal Dust and Facings in the Foundry.

"Coal Dust and Facings in the Foundry" was the title of a Paper by Mr. H. Winterton read at the meeting of the Sheffield Section of the Institute of British Foundrymen held on December 13. It was published in our last issue.

The author of the Paper was unable to be present owing to illness, but his son, Mr. H. T. Winterton, ably deputised and answered questions.

Mr. G. L. Oxley (Branch-President) was in the chair.

Uncontrolled Variables.

The CHAIRMAN said they were all sorry Mr. Winterton, senior, could not come to deliver his lecture, but they would all congratulate his son on the way the Paper was delivered. They also would like to congratulate the author. Lectures like his were bound to improve castings. It was impossible to enunciate any fixed rule as to the amount of coal dust in the sand. One could measure the coal dust and the black sand and give the men the probable measures, but after running for a few weeks one would find castings altering. Then it was time to look to the sand. Even a little variation in the sand would make a considerable difference on the casting. From the illustrations exhibited where the facing sand had been treated with too much coal dust and the casting had been machined and showed up practically clean, he thought they had machined the bottom side of the casting. He felt that if they machined the other side they would probably find a quantity of dirt. If there were any dirt in the casting it would probably come to the top in a thin casting. References to nice skins reminded him that when he was an apprentice he used to bring down common salt and put it into the blacking, and it caused a very fine skin, but there was a tendency, of course, to harden the skin.

MR. GOODWIN (past-President of the Institute) said the various experiments with the mica plates were very interesting. It was very pleasing to find it in a lecture of this sort. He did not think it was unusual to find a blowhole in the position the lecturer had demonstrated to them. If one had a cored casting one could very often trace the blowhole on the outside to a similar interior defect. He would like to ask the lecturer if it was possible to suggest a simple way in the foundry whereby they could tell the percentage of coal dust in the black sand on the foundry floor. He thought still smaller proportions of coal dust could be used, but it wanted to be of such a nature that it would mix more uniformly with the sand being used. He would like to hear another lecture as a continuation of this one, and showing the various kinds of mixing machines at present on the market, so that whilst they had been given an idea as to what they should use in the way of grades they would appreciate a lecture as to how it could be mixed with the materials they used on the foundry floor.

MR. C. PRESSWOOD, B.A., expressed his appreciation of the Paper, and particularly of the view that coal dust formed a protective gaseous layer between the sand and the metal. So important was that, that he wondered, after hearing the speaker, whether the true function of moulding sand was to act as a carrier for coal dust! He found that coal dust was often used in excess, the sand being over-milled and extra coal dust being added in order to open it up again. In mentioning this he would not like to feel that he was acting in a manner calculated to reduce the output of coal from an industry already sadly depressed! Had the lecturer any experience of the use of coal dust in steel moulding sands? He (the speaker) had found that some of the best steel castings he had seen were certainly made in moulds containing coal dust, and he would like to hear an explanation showing why it was so rarely used.

Replying, MR. WINTERTON said he did not intend answering any of the questions, because he would much rather that the author should reply to them. There were just one or two points which interested him, however. Mr. Presswood said that he found that coal dust was used very often in excess. He (Mr. Winterton) quite agreed. Mr. Goodwin wanted a simple way of finding the amount of coal dust in the black sand. If there were a simple way it would be extremely valuable to everyone in the foundry. He did not know whether the author of the paper knew any way or not; that question might be answered in THE FOUNDRY TRADE JOURNAL.

A vote of thanks to the lecturer was proposed by MR. A. FIRTH and seconded by MR. W. BARBER.

[The ignition of a weighed quantity of sand in a tube furnace such as is used for the determination of total carbon in cast iron will give *relative* figures. The sand may require dilution with an inert carbon-free material to prevent too rapid an evolution.—EDITOR, F.T.J.]

Chromite Discovery.—Chromite has been discovered in north-western Ontario by the Consolidated Chromium Corporation, a company recently formed by Golden Center Mines, Inc., and Charles V. Bob & Company. The deposit is close to the main line of the Canadian National Railways, about 30 miles west of Lake Napigon.

Book Review.

Select Methods of Metallurgical Analysis. By WILLIAM ARCHIBALD NAISH, Ph.D., and JOHN EDWARD CLENNEL, B.Sc., with an introduction by SIR HAROLD C. H. CARPENTER. Published by Chapman & Hall. Price 30s. net.

This book is, as its title implies, a work of select methods and covers a very large range for the analysis of all elements in any material. It opens with general methods of sampling, which are followed by qualitative and then quantitative analysis, and closes with a chapter on spectrographic methods of analysis. It contains a mass of information treated in a general way, the estimation of each element being given by several methods, which are supported by an extensive bibliography. The excellent manner in which the chapters are laid out adds considerably to the value of the book.

The aim of the authors has been to compile in concise form a number of recommended methods of analysis. This they have undoubtedly achieved, but it is to be regretted that certain methods are absent which are in general works practice. It will be found that some of the methods suggested might be rejected in many laboratories in view of the lengthy operations involved, because in these works laboratories an important feature is essential, and this is a combination of accuracy and speed. The most outstanding instance of this is in the determination of phosphorus in iron and steel. The methods outlined are the same as in works practice, after a certain point has been reached, but whereas the book under review suggests the old aqua-regia process for the dissolving of the material and a subsequent precipitation of the yellow ammonium phospho-molybdate, the general works practice is one of a much shorter duration and is performed in about one-sixth of the time. Another instance can be cited in this section and that is in the estimation of chromium, where the much-used method outlined by Vignal is omitted.

In the method for estimating graphite in cast iron it is stated that 2 gm. of material should be taken, avoiding as far as possible the dust and fine material. This is contrary to laboratory practice, where a true representative sample is obtained before starting any analysis.

In the section dealing with "Solution and Separation" the authors disagree with many eminent teachers of metallurgical chemistry, inasmuch as they suggest that iron and aluminium are completely separated from chromium in the basic acetate and zinc-oxide separations.

In the method for nickel, it is stated that nickel may be estimated cyanometrically in the presence of small amounts of cobalt, while, according to other authorities, cobalt forms an unstable cyanide, thus rendering a recurring end-point.

Another interesting feature of the book, which is not to be found in other general works, is the portion dealing with the qualitative analysis of the rarer metals. These metals are growing in industrial importance owing to their use, in very small quantities, as additions to various metals and alloys for conferring on them certain desired properties. This section, therefore, will be welcomed by those who are called upon to analyse such mixtures.

The authors are to be congratulated on the excellent manner in which they have tackled a difficult task. From many methods in such a treatise, however, many are bound to dissent, but if it errs in any direction it is fully made up by the variety of methods given. Owing to its brevity, however, it is a book of reference only, and is one which can be appreciated only by an experienced chemist. Sir Harold C. H. Carpenter in his introduction aply describes in a few words the scope of the treatise and at the same time emphasises the need for it.

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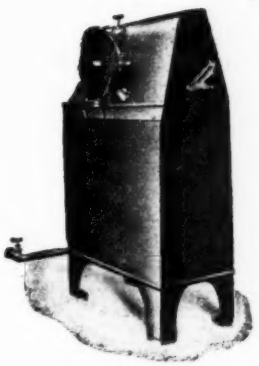
STEAM TURBINE

ADVANTAGES OF UNIT SYSTEM OF HEATING

1. No light-obstructing ducts, interference with overhead gear, or structural alterations necessary.
2. Economy in floor space.
3. Gives heat where required, and each unit can be regulated independently.
4. Warm air delivered at floor level.
5. Can be quickly installed, and is easily removed and re-erected elsewhere.
6. The Unit System can be readily extended, and may be used to supplement existing or insufficient heating plant.



WRITE FOR CATALOGUE No. 3

HEATER UNIT

IMPORTANT FEATURES OF THE STEAM TURBINE UNIT

1. Lower running costs than other types of heater units through the FAN driving power being provided free.
2. No Electric Cables required, only steam and drain connections being necessary.
3. No Reducing Valve required, the Turbine acting in that capacity.
4. No Steam Trap required, complete condensation being obtained.
5. Absence of mechanical trouble.

LONDON
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CARDIFF
NEWCASTLE

DAVIDSON & Co LTD
SIROCCO ENGINEERING WORKS
BELFAST

MANCHESTER
BRISTOL
GLASGOW

GANISTER, CUPOLA BLOCKS, FIRE BRICKS, FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & CO., LTD.

DEEPCAR, nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

TEAM BY-PRODUCT COKE CO., LTD.

DUNSTON-on-TYNE

"TEAM" PATENT COKE

SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—

ALEXANDER LEITH & CO.,
25, COLLINGWOOD STREET,
NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (if necessary guaranteed).

ASH	not exceeding	8%
SULPHUR	,, ,,	0·8%
VOLATILE	,, ,,	1 %
MOISTURE	under	1·50%

Trade Talk.

WE ARE INFORMED that the Mossend steelworks of Messrs. William Beardmore & Company, Limited, have now been closed down, and only watchmen are being employed.

NEGOTIATIONS are said to be proceeding between Dorman, Long & Company, Limited, and the Furness Group (Cargo Fleet and other Companies) for a fusion of interests.

THE LONDON & NORTH EASTERN RAILWAY COMPANY possesses the largest composite wagon in the country. It has fifty-six wheels, and can carry ungainly castings or machinery up to 150 tons in weight.

THE SOUTH AFRICAN RAILWAYS ADMINISTRATION has accepted the tender of the North British Locomotive Company, Limited, for the supply of eighteen locomotives at an approximate cost of £126,000.

MESSRS. LITHGOWS, LIMITED, Port Glasgow, launched, on December 30, the cargo steamer "Knight of St. John," built for Newport Liners, Limited (Messrs. Pardoe-Thomas & Company, Limited), Newport, Mon.

WHILE DAVID SHAW, Whifflet; John Robertson, Coatbridge; and John M'Lean, Summerlee, Coatbridge, were engaged on repairs to No. 6 blast furnace at the Summerlee Iron Works, Coatbridge, they were badly burned about the face, head and arms, and all three had to be removed to hospital.

THE BLYTHSWOOD SHIPBUILDING COMPANY, LIMITED, Glasgow, launched the twin-screw steamer "Talune," built to the order of the Union Steamship Company of New Zealand, Limited. The vessel is 350 ft. long, and is being supplied with propelling machinery by Messrs. D. & W. Henderson, Limited.

THE STAVELEY COAL & IRON COMPANY, LIMITED, at their electricity generating station at the Staveley Works, have achieved a record output, no fewer than 1,730,000 units having been generated in one week for lighting and power purposes for works, collieries, etc. Nearly the whole of the current was generated by the company's gas engines.

THE ANNUAL GENERAL MEETING of the London Iron and Steel Exchange is to be held at the Great Eastern Hotel on Tuesday, January 21, at 12 a.m. The second monthly luncheon arranged by the Committee of the Exchange will take place, also at the Great Eastern Hotel, on January 14, at 1 p.m. A short address will be given by Mr. H. J. Skelton.

MESSRS. ROBERT DUNCAN & COMPANY, LIMITED, Port Glasgow, launched the twin-screw motor vessel "Athelknight" for molasses and oil carrying, built for the United Molasses Company, Limited, London. Two sets of Harland & Wolffe "B. & W." four-cycle single-acting Diesel engines of the enclosed type will be supplied by Messrs. John G. Kincaid & Company, Limited.

THE COMPAGNIE GÉNÉRALE TRANSATLANTIQUE has placed a contract with Messrs. Harland & Wolff, Limited, for the construction of six cargo steamers. Messrs. Harland & Wolff have secured the "blue riband" of shipbuilding for 1929 with a total output of 145,280 tons launched from their Belfast, Clyde and Thames yards. The second place goes to Messrs. Swan, Hunter & Wigham Richardson, Limited, Wallsend-on-Tyne, with 109,195 tons.

A COMPLIMENTARY DINNER and presentation was given by the directors, officials and staff of the Coltness Iron Company, Limited, to Mr. W. R. Wilson, chief sales manager, on the occasion of his leaving the service of the company to take up the management of the newly-formed Caledonian Portland Cement Company, Limited. Mr. A. MacGregor, works manager, presided, and presented to Mr. Wilson a canteen of cutlery and a pair of silver candlesticks for Mrs. Wilson.

MESSRS. ALEXANDER STEPHENS & COMPANY, LIMITED, Linthouse, Glasgow, have launched the cargo steamer "Corrales," 400 ft. long, 51 ft. in breadth, 35 ft. in depth and of about 5,500 tons gross, which they have built to the order of Messrs. Elders & Fyffes, Limited, for their passenger and banana-carrying trade between the West Indies, Central America and the United Kingdom. The propelling machinery consists of triple-expansion reciprocating engines constructed by the builders.

THE ILVA COMPANY is to amalgamate with two other Italian iron and steel companies, the Ferriere di Voltri, which has a share capital of 45,000,000 lire, and the Franchi Gregorini, with a capital of 90,000,000 lire. The Ilva concern will now control about 90 per cent. of the production of pig-iron and 50 per cent. of the steel production of Italy, with considerable economy in the manufacture of rolled products, of iron and steel castings, etc., as it can deal with the manufacture from the ore to the finished products.

MESSRS. BROWETT, LINDLEY & COMPANY, LIMITED, engineers, Sandon Works, Patricroft, Manchester, who have been in the Receiver's hands on behalf of the debenture bond holders, are to be reconstructed. The scheme of reconstruction is already well in hand. We are informed that the firm have a very satisfactory order book, and are developing a full range of oil engines, both of the two-cycle and four-cycle types, also enclosed forced-lubrication steam and gas engines, reciprocating air compressors and condensing plants.

TWO NEW DRIFTERS have been ordered from Buckie firms, and it is hoped that this indicates a revival of building on the Moray Firth coast. Messrs. Herd & Mackenzie have obtained an order from Messrs. James West, Gardenstown, for a steam drifter, to be driven by triple-expansion engines supplied with steam from coal-fired boilers. Messrs. Thomson & Stewart have received an order from Mr. James Murray, Buckie, to build a motor drifter. The vessel will have a speed of nine knots on crude oil by a semi-Diesel engine, and will be specially fitted for herring and seine net fishing.

ACCORDING TO South African papers to hand by the last mail, capital is being raised at the Cape to reopen and work the manganese deposit at Hout Bay, which was exploited unsuccessfully many years ago. The mine is in the hills above the Bay, and has, obviously, very distinct advantages over its Postmasburg competitors in the matter of transport charges and facilities. A well-known German engineer is quoted as advising the reopening of the old mine; and, it is stated, manganese has been so much in the public eye of late that the Capetown public will doubtless readily subscribe the funds necessary to restart operations.

IN VIEW of the recent introduction in this country of golf clubs with steel shafts, it is interesting to note that the leading American firm of steel golf-shaft makers has for some time past been hardening these shafts in electric furnaces designed by Wild-Barfield Electric Furnaces, Limited, of Elecfurn Works, North Road, Holloway, London, N.7, and since the legalisation of the shafts in Great Britain they have received orders for similar equipments for manufacturing in this country. These furnaces are of a very special design, and in addition to a new form of automatic control in regard to temperature, etc., there is also an automatic quenching device.

EMPLOYEES OF THE following firms have made contributions during 1929 to charitable institutions and infirmaries as follow:—Glenboig Union Fire Clay Company, Limited, £143; Messrs. Smith & M'Lean, Limited, Milnwood and Mavisbank works, £662; Bow, M'Lachlan & Company, Limited, Paisley Foundry, £264; David Bennie & Sons, Limited, Springburn, Glasgow, £59; Fullarton, Hodgart & Barclay, Limited, Vulcan Foundry, Paisley, £56; Clyde Structural Iron Company, Limited, Scotstoun, Glasgow, £55; Harland & Wolffe, Limited, Clyde Foundry, Glasgow, £370; Mirrlees, Watson Company, Limited, Glasgow, £312 9s.; Drysdale & Company, Limited, Yoker, £283 19s.; Lion Foundry Company, Limited, Kirkintilloch, £94; Scotts' Shipbuilding & Engineering Company, Limited, Greenock, £1,299; Smith & M'Lean, Limited, Gartcosh Works, £394; and Blantyre Engineering Company, Limited, Hamilton, £98.

THE ANNUAL trade report of Messrs. Cammell Laird & Company, Limited, states that from January, 1929, the activities of the company have been devoted solely to shipbuilding, ship-repairing, marine engineering and boilermaking at their works at Birkenhead. At the end of 1928 the steelworks of the company at Sheffield and Penistone were taken over by the English Steel Corporation, Limited. At the same time their rolling-stock works at Nottingham and those of their controlled companies were acquired by the Metropolitan-Cammell Carriage, Wagon & Finance Company, Limited. The shipyard and engine works have been fairly well employed. Prices, however, showed no upward trend, and they are still unremunerative, while competition for orders is more vigorous than ever. New vessels launched during the year totalled 57,929 gross tons and 41,170 horse-power. At present the company have under construction vessels for the British Admiralty, Canadian National Steamships, Limited, United Molasses Company, Limited, Booth Steamship Company, Limited, Messrs. T. & J. Harrison, the Corporation of Birkenhead, Messrs. Elders & Fyffes, Limited, the Johnstone Line, Limited, and machinery for the cruiser "Dorsetshire."

Personal.

MR. J. E. DOBSON has been appointed by Messrs. Edgar Allen & Company, Limited, to act as their tool-steel specialist and expert demonstrator for Great Britain.

MR. GEORGE REID, who has been for 52 years in the employ of Messrs. William Drysdale & Company, Limited, Bon Accord Works, Yoker, retired at the end of the year. He has been a director of the firm for over 22 years.

MR. S. C. VESSY, president of the W. W. Sly Manufacturing Company, Cleveland, has been unanimously elected by the directors of the American Foundrymen's Association as a director to fill the vacancy caused by the death of Mr. H. Cole Estep.

MR. STANLEY C. ELSE is resigning his position as joint managing director of Messrs. William Cooke & Company, Limited, Sheffield, but will remain on the board. Mr. Leonard H. Else is resigning his position of assistant managing director; he will remain a member of the board and act as general manager. Mr. H. C. Else continues as chairman and managing director of the company.

MR. J. ALLEN THORNTON, works manager of Messrs. Dorman, Long & Company, Limited, Britannia Works, Middlesbrough, has been appointed general manager under Mr. J. Sinclair Kerr, the managing director of the Partington Steel & Iron Company, Limited, Irlam. Mr. Thornton has been with Messrs. Dorman, Long & Company, Limited, for the past twelve years, before which he was with Messrs. Andrew Knowles & Company, Limited, Manchester. A preliminary notice of this appointment was published in our issue of December 19.

Will.

CATTO, J. K., of Messrs. Catto, Mather & Company, iron and steel merchants, Liverpool £13,751

Obituary.

THE DEATH has occurred at his home in Coatbridge of Mr. Frank James Raydon, furnace manager at the British Tubes Works, Coatbridge.

MR. G. HARRY JONES, a director of Messrs. G. R. Jones & Company, Limited, crucible-steel makers and Swedish steel merchants, Sheffield, died recently, aged 52.

THE DEATH has occurred at his home, 2, Parliament Street, Newark, of Mr. T. Jex, aged 43, a core-maker, employed at the Trent Ironworks of Messrs. W. Nicholson & Sons, Limited.

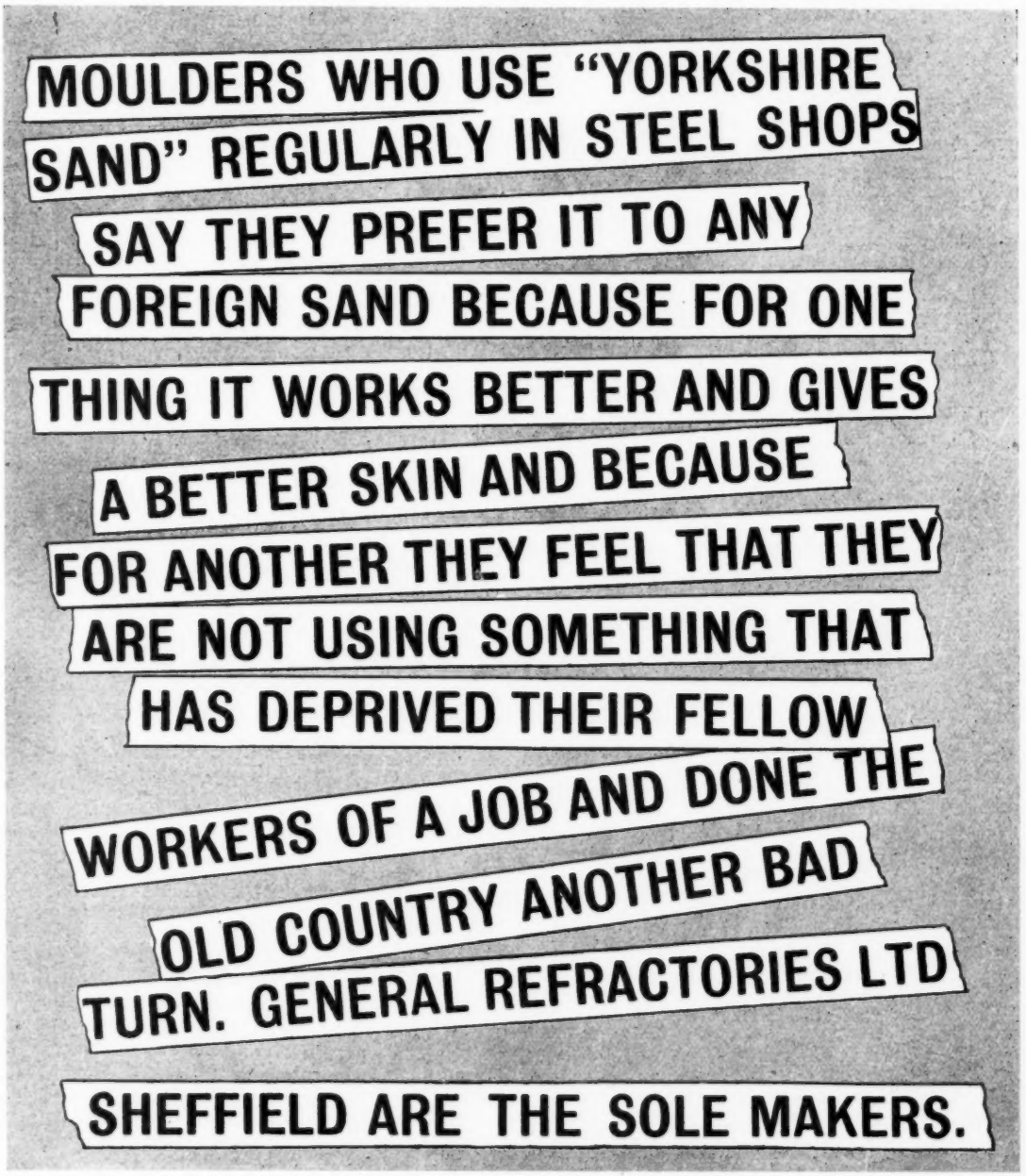
LIEUT.-COMMANDER C. R. READHEAD-TAYLOR, managing director of Messrs. Charles W. Taylor & Son, Limited, ironfounders, of South Shields, died suddenly last week at Harrogate, aged 41.

MR. GEORGE VARDY, who was for many years general manager of the engineering department of Messrs. Swan, Hunter & Wigham Richardson, Limited, died on Christmas Day. He retired a short time ago on completing thirty-three years' service with the Wallsend firm.

MR. HARRY WALKER, for over 20 years chairman of Messrs. Clarke, Chapman & Company, Limited, engineers, of Gateshead, died on Saturday, December 28, in his 74th year. He resigned his chairmanship in September last year, but continued to act as a director. A distinguished engineer, he was a prominent member of several engineering societies.

MR. ALBERT SENIOR, governing director of Messrs. George Senior & Sons, Limited, Swedish iron and steel merchants, Sheffield, and a director of the Sheffield Forge & Rolling Mills Company, Limited, died on Monday, aged 62. He was Consul for Sweden in Sheffield, deputy-chairman of the Applied Science Department of Sheffield University, and a member of the Council of the Sheffield Chamber of Commerce.

THE GREAT WESTERN RAILWAY announces the following items in its development programme for this year:—161 new passenger vehicles; 2,771 freight wagons; 30 locomotives and 70 tank engines; a new steamer for the Fishguard-Rosslare service; a reconstruction programme for bridges, involving the use of 4,000 tons of steel; and new machinery to the value of £70,000. This programme is in addition to that already announced in connection with the Government's unemployment schemes and the remission of passenger duty.


MOULDERS WHO USE "YORKSHIRE
SAND" REGULARLY IN STEEL SHOPS
SAY THEY PREFER IT TO ANY
FOREIGN SAND BECAUSE FOR ONE
THING IT WORKS BETTER AND GIVES
A BETTER SKIN AND BECAUSE
FOR ANOTHER THEY FEEL THAT THEY
ARE NOT USING SOMETHING THAT
HAS DEPRIVED THEIR FELLOW
WORKERS OF A JOB AND DONE THE
OLD COUNTRY ANOTHER BAD
TURN. GENERAL REFRACTORIES LTD
SHEFFIELD ARE THE SOLE MAKERS.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—After a somewhat prolonged holiday, the Cleveland iron market has resumed normal operations, but with little encouraging result as far as actual business was concerned. Following a stoppage of works' activity during the past fortnight, stocks in makers' yards have accumulated on a rather heavy scale, deliveries having been practically suspended, while the furnaces in blast have, of course, been producing as usual. Hopes are, however, expressed that a brisk demand for pig-iron will shortly materialise, many consumers having postponed renewing contracts in the expectation that the New Year might disclose more favourable conditions than those prevailing during 1929. Whether this estimate of the probabilities of the position is accurate can, however, only be a matter for conjecture, dependent mainly on the trend of political action as regards future taxation. Meanwhile, industrial needs north of the Tweed seem to have declined, and, moreover, there have been heavy imports of forign iron into the East Coast ports. Some big contracts were also placed in the Midlands by Scottish consumers, but that was before the last advance in prices, and, while deliveries are still being railed to Scotland under these contracts, it does not appear that the Midland makers have received any substantial share of recent business. Current quotations remain firm and unchanged, as follow:—No. 1 Cleveland foundry iron, 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; No. 4 forge, 71s. per ton.

As in the case of foundry pig, stocks of East-Coast hematite have also accumulated, and in consequence makers are rather more keen to find buyers. Prices in all cases are the subject of negotiation, but, whilst the forward position is very strong, sellers of prompt iron are willing to accept 78s. 6d. per ton for mixed numbers and 79s. for No. 1 quality, while the forward quotation for mixed numbers ranges from 80s. to 81s. per ton. On the North-West Coast, Bessemer mixed numbers are quoted firmly at 77s. 6d. to 78s. per ton at works.

LANCASHIRE.—Conditions in the local foundries are not by any means all that could be desired, but for several months now they have been taking fair quantities of iron, and sellers are hopeful that, even if the rate is not improved upon, there will be no diminution in the aggregate tonnage. Quotations for Staffordshire and Derbyshire brands of No. 3 are very firm at 77s. per ton, with Scotch brands at about 95s. per ton, all delivered to local consumers.

THE MIDLANDS.—At Birmingham this week there has been a fairly active inquiry for supplies of foundry pig, and some difficulty has been experienced in obtaining prompt deliveries. Quotations, however, remain firm at the minimum zone rates of 75s. for No. 3 Northants and 78s. 6d. for Derbyshire No. 3 and North Staffordshire No. 3, with Scotch brands at 96s. 6d. to 97s. 6d., all per ton delivered local stations.

SCOTLAND.—Resuming business after the New Year celebrations, the markets for Scotch pig disclose little change in the general position, with the basis price of 78s. for No. 3 foundry iron at the furnace still in force, but this figure, compared with other irons, is not excessive, and makers would like to see it advanced further in order to reduce their losses.

Finished Iron.

At Birmingham this week the demand for Staffordshire marked bars has been well maintained at the satisfactory level of £12 10s. at works. There continues to be a dearth of business emanating from this area for crown bars, and the mills are quite unable to get sufficient business to keep going regularly. Prices of crown bars vary from £10 to £10 10s., an average figure being £10 5s. for local iron. There is no change in the position affecting nut and bolt bars. Most of the business from the Darlaston area is going to the Continental works, solely on account of price. The foreign offers are round about £6 6s., delivered works in this area, whereas the cheapest Staffordshire bolt iron would be at £9 5s.

Steel.

At Sheffield the steel market continues fair, and only a moderate amount of business was reported in either British or Continental semi-finished material. The Continental prices are stabilised, and this, coupled with the firmness of the pig-iron market, results in the values of home-produced semis being maintained. The cessation of market operations in Brussels for the New Year holidays has restricted business on the Continent, where conditions generally are irregular. In the tinplate market makers generally have started the New Year with comfortable order-books, and quotations may be called:—Coke tinplates, 18s. 9d. to 18s. 10½d. basis, net cash, f.o.b. Wales.

Scrap.

Markets, both for ferrous and non-ferrous foundry scrap metals, are now showing signs of a revival of demand, with, in some instances, a rather firmer tendency in prices. On Tees-side the heavy foundries are only moderately busy so far, and no more than 62s. 6d. can be obtained for ordinary heavy cast iron, although good machinery quality in convenient sizes is sufficiently scarce to command 66s. 6d. per ton. In Yorkshire, business in scrap continues slow for the time being, with heavy cast-iron scrap in only moderate request at about 62s. 6d. for ordinary and 65s. 6d. for machinery quality. Deliveries to foundries in Scotland are only partially resumed as yet, but little change in current values of the leading lines in cast-iron material are anticipated till later in the year.

Metals.

Copper.—The revival of active interest in markets for basic metals towards last week's close resulted in an upward movement of values, and indicating increasing strength in consumptive demand, both at home and abroad. The producers at the moment, however, hold firmly to the idea that the consumers, who are not very well supplied, will have to come into the market for large quantities, while consumers are restricting their purchases and hoping that prices will have to be cut.

Closing quotations are:—

Cash.—Thursday, £71 7s. 6d. to £71 10s.; Friday, £69 15s. to £70; Monday, £70 2s. 6d. to £70 5s.; Tuesday, £71 10s. to £71 12s. 6d.; Wednesday, £71 12s. 6d. to £71 15s.

Three Months.—Thursday, £70 to £70 2s. 6d.; Friday, £68 7s. 6d. to £68 10s.; Monday, £68 17s. 6d. to £69; Tuesday, £69 17s. 6d. to £70; Wednesday, £69 10s. to £69 12s. 6d.

Tin.—A somewhat sharp advance in tin values last week has been followed by less satisfactory conditions, and the present trend of prices is quite uncertain. Disappointment was expressed in the result of the December returns, showing the smallest deliveries for ten months, while the total visible supply at the end of the year amounted to 32,400 tons, or an increase of more than 7,000 tons compared with the position at the end of 1928. This increase in stocks has taken place in spite of an advance of more than 13,000 tons in total deliveries into consumption.

Official closing prices:—

Cash.—Thursday, £180 5s. to £180 7s. 6d.; Friday, £175 10s. to £175 12s. 6d.; Monday, £175 to £175 2s. 6d.; Tuesday, £176 2s. 6d. to £176 5s.; Wednesday, £178 7s. 6d. to £178 12s. 6d.

Three Months.—Thursday, £183 12s. 6d. to £183 15s.; Friday, £178 15s. to £179; Monday, £178 5s. to £178 7s. 6d.; Tuesday, £179 5s. to £179 7s. 6d.; Wednesday, £181 12s. 6d. to £181 15s.

Spelter.—The Zinc Convention, having failed in its object to restrict production, has come to an end, in spite of all efforts to prolong it. The world's output is increasing month by month, and there seems not much likelihood of a permanent increase in the price, which at the moment is abnormally low. Stocks are very large indeed, and it is only the fact that consumers have small stocks in hand which keeps the market as high as it is.

Daily quotations are:—

Ordinary. — Thursday, £19 15s.; Friday, £19 12s. 6d.; Monday, £19 8s. 9d.; Tuesday, £19 15s.; Wednesday, £19 15s.

Lead.—The market for soft foreign pig continues quiet, but, owing to the recent holidays, only a small amount of business is passing. The outlook for the present year is quite good.

The week's prices have been:—

Soft Foreign (Prompt).—Thursday, £21 10s.; Friday, £21 10s.; Monday, £21 10s.; Tuesday, £21; Wednesday, £21 11s. 3d.

The Light-Castings Industry in Falkirk.

Foreign Competition.

The New Year holidays ended on January 6, and a fairly general resumption of work in the Falkirk foundries. The hope prevails that 1930 will be marked by a revival of trade in the light castings industry. Compared with the preceding twelve months, there was experienced during 1929 a considerable improvement in the industry. The position is still, however, rather difficult, and manufacturers cannot see very far ahead, because the work in hand is largely of the day-to-day order. During August and September there was a fairly heavy demand consequent upon the alteration which took place on September 30 in the terms of the housing subsidy in England. There was at that time an extra push to complete as many houses as possible before the subsidy change took place. Since then there has been a lull, and works are now in a position that is described as none too bright. There is still a fair amount of housing scheme work to be undertaken, and the hope prevails that there will be a marked revival in the early months of this year.

Continental Copies of British Patterns.

The industry is still suffering severely from foreign imports. Continental baths continue to come into this country in large numbers, although, compared with two years ago, the average monthly imports are less. Yet, when account is taken of the fact that the total consumption of baths in England and Scotland has also decreased considerably, the foreigners are still supplying practically the same proportion. The average imports at present are approximately 6,000 baths per month. When unemployment in this branch of the industry is kept in view, it will be realised what a serious matter this continual influx of foreign-made goods is to all concerned. The founders are finding another disquieting feature in the increase in the importation of Continental-made rain-water and soil pipes. British patterns have been copied, and, by selling at prices which home manufacturers cannot possibly quote, the foreign makers are making a determined attempt to capture this market also. Apart from the serious aspect of these matters from the viewpoint of the ironfounders and the workers employed in the industry, it is found that these imported goods are not only throwing British workmen on the dole, but are actually being installed in housing schemes subsidised by British taxpayers' money. Falkirk manufacturers are inclined to question the sanity of present arrangements with regard to such matters. So far as export markets are concerned, the principal Falkirk foundries can still hold their own in many specialised lines, but it seems that in this sphere the position is also becoming very difficult. In many of the overseas markets local works have been established and developed, and these are able to largely meet the demands. In the case of porcelain enamelled baths, which form a large part of the Falkirk export trade, Continental manufacturers are successfully competing in many of the overseas markets, and are offering prices which are quite impossible to Falkirk makers.

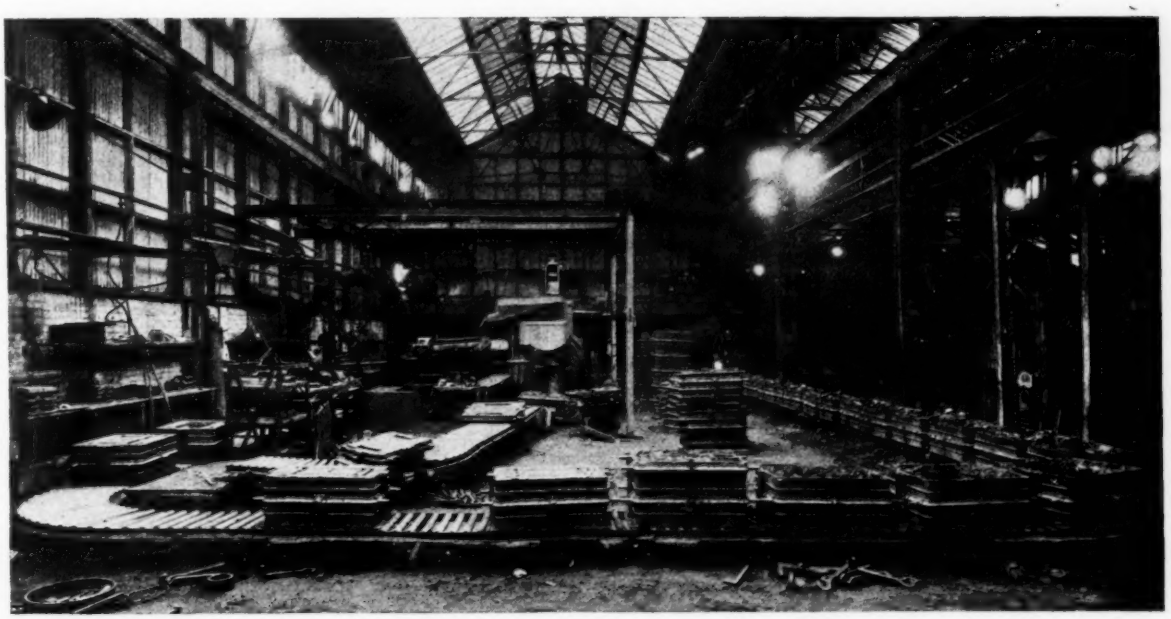
WE REGRET to announce the death of Mr. Thomas Whyman, managing director of Whyman's Foundry Company, Limited, Warrington, which occurred on January 7.

Eliminating Wasted Effort with STERLING BOXES

STERLING BOXES are ideal for the modern foundry, where rapid handling is essential.

They are made from solid ribbed rolled steel. Light and easy to handle, rigid, durable, permanently accurate, cannot crack or break.

LET YOUR NEXT LOT OF BOXES BE "STERLINGS."



View of a Modern British Foundry showing STERLING BOXES used in conjunction with Conveyor.

STERLING FOUNDRY SPECIALTIES LTD.

London Office:
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BEDFORD.

Telephone: 3345 BEDFORD.
Telegrams: "STERFLASK, BEDFORD."
Code: WESTERN UNION.

Glasgow: ALBERT SMITH & CO., 60, ST. ENOCH SQUARE, GLASGOW, C.1.
Newcastle-on-Tyne: LAWSON, WALTON & CO., LTD., HANDYSIDE ARCADE, NEWCASTLE-ON-TYNE.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	71	12	6
Three months	69	10	0
Electrolytic	83	5	0
Tough	76	0	0
Best selected	76	10	0
Sheets	110	0	0
India	90	10	0
Wire bars	84	0	0
Do. Jan.	84	0	0
Do. Feb.	84	0	0
Ingot bars	84	0	0
H.C. wire rods	86	2	6
Off. av. cash, December	68	7	3½
Do., 3 mths., December	67	15	10⅝
Do., Sttlmnt., December	68	7	3
Do., Electro, December	83	3	6½
Do., B.S., December	75	16	4⅝
Do., wire bars, December	83	15	9
Aver. spot price, copper, Dec.	68	7	3½

Solid drawn tubes 15d.
Brazed tubes 15d.
Wire 11½d.

BRASS.

Solid drawn tubes 12¾d.
Brazed tubes 14¾d.
Rods, drawn 12½d.
Rods, extd. or rlld. 7½d.
Sheets to 10 w.g. 11½d.
Wire 10¾d.
Rolled metal 10½d.
Yellow metal rods 7½d.
Do. 4 × 4 Squares 8d.
Do. 4 × 3 Sheets 8½d.

TIN.

	£	s.	d.
Standard cash	178	7	6
Three months	181	12	6
English	179	5	0
Bars	179	0	0
Straits	178	2	6
Australian	177	12	6
Eastern	180	7	6
Banca	184	2	6
Off. av. cash, December	179	10	2¼
Do., 3 mths, December	182	14	0
Do., Sttlmt., December	179	9	7½
Aver. spot, December	179	10	2¼

SPELTER.

	£	s.	d.
Ordinary	19	15	0
Remelted	18	10	0
Hard	16	10	0
Electro 99.9	22	0	0
English	20	2	6
India	18	0	0
Zinc dust (Nom.)	31	10	0
Zinc ashes	6	10	0
Off. aver., December	20	7	5½
Aver., spot, December	20	1	3¼

LEAD.

	£	s.	d.
Soft foreign ppt.	21	11	3
English	23	0	0
Off. average, December	21	9	6¾
Average spot, December	21	9	5¼

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	30	0	0
Do. V.M. ex-whf.	27	15	0
Rods	34	0	0
Boiler plates	26	10	0
Battery plates	27	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	48	15	0
Chinese	30	0	0
Crude	19	0	0

QUICKSILVER.

Quicksilver £23 0 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	17	6
45/50%	11	10	0
75%	19	0	0
Ferro-vanadium—			
35/50%	12/9 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbonless	9d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80.85%, c. fr.	3/1½ lb.		
Tungsten metal powder—			
98.99%	3/4½ lb.		
Ferro-chrome—			
2/4% car.	£30	10	0
4/6% car.	£23	7	6
6/8% car.	£22	15	0
8/10% car.	£22	7	6
Ferro-chrome—			
Max. 2% car.	£33	12	6
Max. 1% car.	£39	0	0
Max. 0.70% car.	£41	2	6
70% carbonless	11d. lb.		
Nickel—99% cubes, or pellets	£175	0	0
Ferro-cobalt	9/6 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£12	10	0
76/80% packed	£13	10	0
76/80%, export	£12	15	0
Metallic manganese—			
94/96%, carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten £0 2 0
Finished bars, 18% tungsten £0 2 9
Per lb. net, d/d buyers' works.

Extras—
Rounds and squares, 3 in. and over 4d. lb.
Rounds and squares, under ½ in. to ¼ in. 3d. lb.
Do., under ¼ in. to $\frac{3}{16}$ in. 1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in. 3d. lb.
Do., under ½ in. × ¼ in. 1/- lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel				3	7	6
Bundled steel and shrngs.	3	3	6 to	3	6	0
Mixed iron and steel	3	2	6 to	3	3	6
Heavy cast iron	2	18	0 to	3	0	0
Good machinery for foundries	3	2	6 to	3	5	0
Cleveland—						
Heavy steel				3	3	6
Steel turnings				2	16	6
Cast-iron borings				2	13	0
Heavy forge				3	15	0
W.I. piling scrap				3	10	0
Cast-iron scrap	3	2	6 to	3	6	6
Midlands—						
Ord. cast-iron scrap				3	5	0
Heavy wrought				3	17	6
Steel turnings	2	2	6 to	2	5	0
Scotland—						
Heavy steel				3	9	0
Cast-iron borings				2	12	0
Wrought-iron piling				3	19	0
Heavy machinery				3	10	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	61	0	0
Brass	43	0	0
Lead (less usual draft)	19	0	0
Tea lead	15	0	0
Zinc	13	10	0
New aluminium cuttings	65	0	0
Braziery copper	57	0	0
Gunmetal	54	0	0
Hollow pewter	132	0	0
Shaped black pewter	98	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—

Foundry No. 1	75/-
Foundry No. 3	72/6
Foundry No. 4	71/6
Forge No. 4	71/-
Hematite No. 1	79/-
Hematite M/Nos.	78/6

N.W. Coast—

Hem. M/Nos. d/d Glas.	86/-
,, d/d Birm.	93/6

Midlands—

Staffs. common*	—
,, No. 4 forge*	74/6
,, No. 3 fdry.*	78/6
Shrops. basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	71/-
,, fdry. No. 3*	75/-
Derbyshire forge*	74/6
,, fdry. No. 3*	78/6
,, basic*	—

*d/d Black Country dist.

Scotland—

Foundry No. 1	80/6
,, No. 3	78/-
Hem. M/Nos.	81/-

Sheffield (d/d district)—

Derby forge	69/6
,, fdry. No. 3	73/6
Lincs. forge.	72/-
,, fdry No. 3	77/-
E.C. hematite	89/-
W.C. hematite	91/6

Lincs. (at furnaces)—

Forge No. 4	—
Foundry No. 3	—
Basic	—

Lancashire (d/d eq. Man.)—

Derby forge	—
,, fdry. No. 3	77/-
Northants foundry No. 3	—
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	95/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	95/-
Monkland, No. 3	95/-
Shotts, No. 3	95/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.				10	15	0
Nut and bolt iron	9	2	6 to	9	7	6
Hoops				11	0	0
Marked bars (Staffs) f.o t.				12	10	0
Gas strip				11	0	0
Bolts and nuts, ¾ in. × 4 in.				15	5	0
Steel—						
Ship plates	8	15	0 to	8	17	6
Boiler plts.	9	15	0 to	10	10	0
Chequer plts.				10	12	6
Angles				8	7	6
Tees				9	7	6
Joists				8	10	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ¾ in. (Untested)				8	2	6

and upwards

Flats—8 in. wide and over	8 12 6
,, under 8 in. and over 5 in.	8 17 6
Rails, heavy	8 10 0
Fishplates	12 10 0
Hoops (Staffs)	9 15 0
Black sheets, 24 g.	9 17 6
Galv.cor.shts., 24g.	12 7 6 to 12 12 6
Galv. fencing wire, 8g. plain	12 0 0
Billets, soft	6 2 6 to 6 12 6
Billets, hard	7 10 0 to 8 0 0
Sheet bars	5 17 6 to 6 5 0
Tin bars	5 17 6 to 6 5 0

PHOSPHOR BRONZE.

Per lb. basis.

Strip	1/4
Sheet to 10 w.g.	1/5
Wire	1/6
Rods	1/5
Tubes	1/9½
Castings	1/4

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

per lb.

Ingots for raising	10d. to 1/4
Rolled—	
To 9 in. wide	1/4 to 1/10
To 12 in. wide	1/4½ to 1/10½
To 15 in. wide	1/4½ to 1/10½
To 18 in. wide	1/5 to 1/11
To 21 in. wide	1/5½ to 1/11½
To 25 in. wide	1/6 to 2/-
Ingots for spoons and forks	10d. to 1/6½
Ingots rolled to spoon size	1/1 to 1/9½
Wire round—	
3/0 to 10 G.	1/7½ to 2/2½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y, at mill	43.00
Bessemer billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	35.00
Wire rods	40.00
	Cents
Iron bars, Phila.	2.12
Steel bars	1.90
Tank plates	1.90
Beams, etc.	1.90
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.75
Sheets, galv., No. 24	3.40
Sheets, blue an'l'd, No. 13	2.13
Wire nails	2.40
Plain wire	2.40
Barbed wire, galv.	3.05
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	35/- to 36/-
,, furnace	30/- to 32/6
Durham and Northumberland—	
,, foundry	19/-
,, furnace	20/3
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box	18/9
,,	28×20 ,,	38/-
,,	20×10 ,,	27/6
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	16/-
,,	28×20 ,,	34/-
,,	20×10 ,,	22/7½
,,	18¾×14 ,,	16/-
Terneplates	28×20	33/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.
Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	65%	47½%
Water	61½%	42½%
Steam	57½%	37½%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Jan.	2	71	7	6	inc.	70/–
,,	3	69	15	0	dec.	32/6
,,	6	70	2	6	inc.	7/6
,,	7	71	10	0	,,	27/6
,,	8	71	12	6	,,	2/6

Electrolytic Copper.

		£	s.	d.					
Jan.	2	83	0	0	No	change			
,,	3	83	0	0	,,	,,	,,		
,,	6	83	0	0	,,	,,	,,		
,,	7	83	5	0	inc.	5/–			
,,	8	83	5	0	No	change			

Standard Tin (cash).

		£	s.	d.		
Jan.	2	180	5	0	inc.	42/6
,,	3	175	10	0	dec.	95/–
,,	6	175	0	0	,,	10/–
,,	7	176	2	6	inc.	22/6
,,	8	178	7	6	,,	45/–

Tin (English ingots).

		£	s.	d.					
Jan.	2	181	0	0	inc.	40/–			
,,	3	176	5	0	dec.	95/–			
,,	6	176	0	0	,,	5/–			
,,	7	177	0	0	inc.	20/–			
,,	8	179	5	0	,,	45/–			

Zinc Sheets (English).

		£	s.	d.					
Jan.	2	30	0	0	No	change			
,,	3	30	0	0	,,	,,	,,		
,,	6	30	0	0	,,	,,	,,		
,,	7	30	0	0	,,	,,	,,		
,,	8	30	0	0	,,	,,	,,		

Spelter (ordinary).

		£	s.	d.		
Jan.	2	19	15	0	inc.	2/6
,,	3	19	12	6	dec.	2/6
,,	6	19	8	9	,,	3/9
,,	7	19	15	0	inc.	6/3
,,	8	19	15	0	No	change

Lead (English).

		£	s.	d.		
Jan.	2	23	0	0	dec.	5/–
,,	3	23	0	0	No	change
,,	6	23	0	0	,,	,,
,,	7	23	0	0	,,	,,
,,	8	23	0	0	,,	,,

AVERAGE MONTHLY PRICES OF WEST COAST HEMATITE MIXED NUMBERS DELIVERED SHEFFIELD.

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1888	44 4	42 3	42 1½	42 0	41 2½	42 1½	42 6½	44 0	45 8½	44 6	44 6	45 3½	43 4
1889	44 4	45 2	47 3½	48 9½	48 6½	48 7½	50 1½	53 11	55 3	63 6	73 10	73 2	54 4½
1890	76 1½	65 1	63 3	55 1	53 9½	50 11	52 3½	56 4	58 0	58 2	57 5	54 4½	58 5
1891	52 9	50 10	48 11	47 9½	51 5	50 6	50 10	48 4	50 1	49 1½	48 3½	47 8	49 8½
1892	47 4	45 6	46 4½	47 8	49 5	50 4½	49 7½	49 10½	48 8½	46 10	46 1½	46 1½	48 2½
1893	46 0½	45 8	45 11	45 7	44 11	44 9½	44 10	45 3	45 0	44 6	44 7	45 8	45 3
1894	45 3	45 3	45 1½	45 1	43 11	43 11	43 9½	44 2	44 7½	43 7	43 5	43 3	44 3½
1895	42 8	42 5½	42 6	42 10	43 10	43 7½	44 10	45 11	49 11	48 9	47 7½	47 7½	45 2½
1896	47 0	48 9	48 9	48 2½	47 3	47 3	46 10	46 10	47 2	48 5	50 7	50 6	48 1½
1897	51 2	49 10	48 5	47 4	47 9½	48 6	47 0	47 3	47 3	47 0	48 3½	47 11	48 2
1898	48 9	48 10	49 4	49 8½	50 10	50 3½	51 0	52 5	53 11	55 8	57 3	56 10	52 1½
1899	59 1	59 9	57 7	59 6	64 7	70 10½	76 7½	72 2	74 3	75 0	78 1½	73 3	68 5
1900	75 3½	76 10	79 10	84 6	81 4	79 1½	83 4	81 5	79 11	76 10	77 8½	68 4	78 8
1901	60 2	59 0	57 9½	57 6½	57 8	57 4½	57 8	61 0	60 0½	59 9	58 7½	56 7	58 7½
1902	56 1	57 9½	59 3½	59 9	59 10½	60 0	60 0	60 8½	61 5	61 2	59 3	59 0	59 6
1903	58 5	58 8	61 1	59 5	57 10	57 3	56 7	56 3	55 9	54 8	52 4	52 4	56 8½
1904	52 8½	53 1	53 7	54 9	54 2	53 2½	52 9	52 5	52 2½	52 7	53 1	55 11½	53 5½
1905	57 9½	56 9	58 1	58 2	56 4	55 8	55 5½	56 7	61 0	68 9	69 9	70 11½	60 5½
1906	70 4½	65 2½	63 4½	63 9	64 5	64 6	64 1	66 2½	67 3	69 4½	72 4½	78 8½	67 5
1907	77 9	72 11	71 10	73 9	79 9½	76 9	77 9	78 4	75 11	72 9½	68 6	66 7	74 4
1908	62 7	59 1	61 6½	61 6½	61 4	59 1	57 9½	56 11	60 2	59 2	58 5½	57 7	59 7½
1909	51 4	56 5	55 3	56 1	56 4	57 0	56 8	58 0	61 0	61 1½	60 7½	61 4	58 1½
1910	64 0½	64 3½	66 10½	67 6½	66 2½	65 4	64 4½	65 6½	65 2	64 10½	64 6	65 6	65 4½
1911	66 9	66 1	64 10	63 1	62 1	62 0	61 2	62 2	62 1	61 1	61 10	64 0	63 1
1912	67 0	67 0	67 0	69 3	71 9½	72 11	75 9½	79 1½	82 2½	85 0	85 3½	86 6	75 9½
1913	86 6	86 6	86 3	85 0	83 6½	80 10½	78 1	76 10½	72 6	71 0	68 0	65 3	78 4½
1914	64 6	65 4½	65 6	64 11½	64 2½	64 0	64 0	68 11½	74 6½	71 0	65 4½	69 9½	66 10½
1915	78 9	100 6	103 1	113 6	111 9	114 0	116 3	115 2½	113 8½	121 1½	131 9½	139 6½	113 3
1916	135 0	135 0	133 4	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	129 2½
1917	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6
1918	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6
1919	127 6	127 6	127 6	127 6	180 6	184 3	195 4½	204 6	204 6	204 6	204 6	204 6	174 7
1920	224 9	235 0	245 0	275 0	290 0	295 0	295 0	295 0	295 0	295 0	295 0	280 0	284 11½
1921	263 4	228 4	180 0	180 0	180 0	160 0	160 0	157 6	142 0	128 6	121 0	115 6	167 9½
1922	125 0	117 6	115 0	115 0	115 0	115 0	113 1½	104 0	105 0	105 0	106 3	110 0	112 1½
1923	109 0½	116 5½	133 11½	138 3½	134 2	125 0	115 7½	111 9	110 0	110 0	113 11	115 0	119 5½
1924	115 0	115 0	114 4½	112 6	112 6	112 6	111 0	110 0	110 0	105 4½	102 6	102 6	110 3½
1925	102 6	102 6	100 0	98 6	97 6	95 1½	92 6	90 6	88 3	87 0	88 1½	88 9½	94 3½
1926	90 1½	90 0	89 8½	89 0	89 0	89 0	90 2½	91 9	94 0	97 2½	*	*	91 0
1927	95 4½	95 6	96 6	95 6	95 3	94 0	92 10½	91 6	90 6	90 6	90 6	89 6	93 1½
1928	85 0	85 3	85 5	85 0	85 3	84 9	84 0	83 9	84 0	84 0	83 1	82 6	84 4
1929	82 10½	83 6	85 0	86 9	87 0	87 0	87 3	87 2½	87 6	89 6	89 6	89 10½	86 11

* No prices available.

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

REGISTERED TRADE MARK
LIMPET

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
19, ST. VINCENT PLACE, GLASGOW.
ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-.

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ADVERTISER desires position as Foundry Manager or Foreman; practical and technical training all branches iron and non-ferrous work; expert on cupola, mix grey iron, semi-steel, and non-ferrous metals by analysis; knowledge of engineering and pattern shop; can estimate and fix piecework prices.—Box 412, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

NON-FERROUS FOUNDER, young, practical, studious, nine years' jobbing foundry experience, capable of full control of small foundry, seeks progressive position, home or abroad.—Box 410, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FURNACEMAN wanted immediately, one having had experience with pit fires and the cupola. Only those with experience on both types of furnace need apply. State fully where experience gained, age, and wages required. Constant work for the right man.—Apply, H. H. MARTYN & COMPANY, LIMITED, Sunningend Works, Cheltenham.

PROPERTY.

11 ACRES WORKS SITE.
SHEFFIELD.
145,000 Sq. Ft. of SHOPPING,
Compact and Convenient.
SIDING CONNECTIONS
with L.M. & S. and L. & N.E. Rlys.
WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—
THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

BARGAIN IN TRAFFORD PARK.—Engineering Works and Foundry; private sidings, warehouse, packing rooms; fine offices; central heating; all on one storey and easily adaptable; cost £20,000 in 1921—price £2,000, including two 4-ft. Modern Cupolas and Steel Chimney.—F. S. AIREY, ENTWISTLE & COMPANY, 10, Norfolk Street, Manchester.

TENDER.

ARMY CONTRACTS.

NOTICE IS HEREBY GIVEN that Tenders for quantities of the undermentioned manufactured goods are invited from time to time, as required:—

Metal Trades.

Aluminium (ingot), Brass, Brass (rod and sheet), Bronze Stampings, Copper (ingot and sheet), Lead (pig and sheet), Metal Rod, Nickel, Pig-iron, Steel (plate, rounds, sheets, etc.), Shell Steel, Tin (ingot), Tinplates, Zinc (ingot and sheets).

Baths, Bicycles, Building Materials and Fitments, Cutlery (including safety razors and blades), Enamelled Ware, Hollow-ware, Horseshoes, Ironmongery, Machinery, Pipes (steel and cast iron), Stable Fitments, Stoves and Ovens, Sanitary Appliances, Tinware, Tools, Vehicles, Wire, Wire Rope.

Electrical and Scientific Instrument Trades.

Cables, Electrical Plant, Electrical and Wireless Stores, Scientific Instruments.

Textile Trades.

Blankets and Rugs, Braid and Lace, Canvas and Canvas Goods, Clothing (made up from Department's own materials), Cotton Piece Goods and Cotton Goods, Cordage, Flannel (Union), Head-dresses, Horse Rugs, Hosiery, Linen Piece Goods, Silk Cloth and Webbing and Sewing Silk, Towels, Woollen Cloths.

Foodstuffs, Coal and Coke.

Other Trades.

Badges and Buttons, Basket-ware, Bedding, Boots and Shoes, Brooms and Brushes, Chemicals and Gases, China and Earthenware, Furniture, Harness and Saddlery, Leather and Leather Goods, Linoleum, Medical Supplies, Oils and Spirits, Paints and Varnishes, Rubber Boots and Clothing, Timber, Woodware.

Manufacturers who are not already on the War Office List of Tenderers, and who may wish to be invited to tender for Army requirements of the above stores, should apply to the Director of Army Contracts at the address given below for Form 1, on which formal application for inclusion on the list of tenderers may be made. The services of an intermediary are unnecessary in approaching the Department for this purpose.

Before being placed on the lists of tenderers, firms will have to satisfy the Department that they actually manufacture goods for which they wish to be noted, and will be required to furnish the names of at least two well-known firms or public bodies who have purchased from them and are in a position to certify as to the quality of their productions. They will further have to give an undertaking that they will comply with the Fair Wages Resolution of the House of Commons.

Attention is called to the following resolution passed by both Houses of Parliament on February 16, 1926:—

"That, in the opinion of this House, it is the duty of the Government in all Government contracts to make provision for the employment to the fullest possible extent of disabled ex-service men, and to this end to confine such contracts, save in exceptional circumstances, to employers enrolled on the King's National Roll."

Sales.

From time to time the Department has for sale surplus Army stores of various descriptions, among which may be mentioned Machinery, Steel Girder Bridges, Scrap Metals, Hutting, Motor Vehicles, Drugs, Medical and Dental Stores, Veterinary Stores, Optical and Scientific Instruments, Electrical and Wireless Stores, Clothing, Boots, Textile Goods, Paint.

Firms who wish to be invited to tender for the purchase of surplus stores should apply as directed below.

All applications should be in writing and should be addressed to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, London, S.W.1. No application is necessary from firms whose names are already on the War Office lists, unless they have extended the range of their manufactures.

FRANCIS OSBORN,
Director of Army Contracts.

MACHINERY.

SAND MIXERS.—New and Secondhand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Prospect Works, Hawksley Avenue, Sheffield.

'Phone: 287 SLOUGH

TABOR
"SHOCKLESS" MACHINES

8" Plain jolter, 51" × 42" table	£90
13" Plain jolter, 76" × 52" table	£140
24" × 48" Portable turnover jolter	£130
18" × 36" Portable turnover jolter	£90
30" × 40" Turnover jolter, 20" draw	£140
50" × 60" Turnover jolter, 30" draw	£440
"ADAPTABLE" machine, standard type	£15

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